THE
ELECTRICAL REVIEW

Volume CXXIX — No. 3324

Friday, August 8, 1941

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THE
ELECTRICAL REVIEW
THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXIX. No. 3324. AUGUST 8, 1941 6d. WEEKLY

Good Mining Practice

The New Electrical Regulations

It is, no doubt, a tribute to the efficiency of the regulations governing the use of electricity in collieries that the eighteenth annual report of the Safety in Mines Research Board (Stationery Office, 1s. net) contains so little reference to the subject. Indeed, the only direct mention of electricity is to be found in a brief statement that the E.R.A. is conducting experiments at Buxton to ascertain the " safe gaps " for explosive gases.

Nevertheless the present regulations have been in force for twenty-eight years and are ripe for revision in the light of experience of their working and of technical advances made since they first appeared. Recently we reviewed a revised set of regulations based on technical advances made in the intervening period. While it is not proposed to enforce their provisions now, in view of present circumstances, attention should be given to their principal features with a view to securing conformity as soon as statutory authority is given to the draft.

Three main risks arise, namely, ignition of fire-damp, fire and electric shock. With regard to the first of these, the standard is now adequacy of ventilation. This has a bearing on the loading of motors also, which is now logically related to temperature rise rather than to name-plate ratings. Flame-proof enclosure is obligatory in safety-lamp seams within 300 yd. of the coal face, but that does not mean that even officially approved apparatus may be installed in explosive atmospheres. Nor is flame-proof enclosure the sole criterion for granting Mines Department certificates.

The use of low voltage although providing immunity from shock does not eliminate the chances of explosion, but it should not be difficult to make inductive circuits for remote control and interlocking intrinsically safe in the manner indicated in the regulations.

No efficient substitute for oil-immersed apparatus is available, but the possibilities of fire can be greatly lessened by restricting the amount of oil near the working face to 50 gal. This would cover the requirements of a 40-kVA transformer, whereas the largest capacity which has so far received a flame-proof certificate is only 5-kVA, needing about 10 gal. of oil.

A further safeguard against fire, although it bears on fire-damp ignition and shock aspects as well, is the provision that all AC circuits above 125 V shall incorporate earth-leakage protection. In view of the large proportion of accidents associated with flexible cables, the requirement that such cables shall be of the screened type made up with an earthing core is most welcome.

To be commended also on anti-shock grounds is the obligatory use of electrical interlocks with unbolted plug-and-socket couplings on AC flexible cables for connecting portable apparatus operated at more than 125 V. In quality of construction, apparatus must be at least equal to that called for in relevant British Standard Specifications.

It is to be hoped that the draft regulations will be worked to forthwith by mine

managers and manufacturers as far as they may be practicable in present conditions, thus avoiding possible additional expense in modifying designs later as well as raising the standard of safety in the more immediate future.

Meter Jewels

AN appreciable extension of the life of jewels and pivots of electric meters can often be obtained by cleaning, and the appropriate treatment which we have been asked by the Electricity Commissioners to bring to the notice of interested parties. The work calls for considerable skill and experience, even though advantage be taken of the wartime modification allowed by the Commissioners of testing for low-load performance at one-tenth instead of one-twentieth of full capacity. In view of the need to make the fullest use of existing facilities, undertakings lacking the requisite staff or equipment are urged to make the necessary arrangements with their neighbours. The good offices of the area meter examiners are available in this connection.

Trends in Generation

INTEREST is added to the installation of a 100,000-kW turbo-alternator at Burlington generating station, New Jersey (described in this issue) by an inquiry made by the editors of *Power*. A number of supply engineers in the United States were asked which of the many new plants they would select for a design representing stable trends for the future. Nearly all of those approached chose Burlington. The British station most resembling it is Battersea B, but there are notable differences, two of the most obvious of which are the use of hydrogen cooling in the American instance and the equal rating of the high- and low-pressure alternators, both of which are two-pole machines.

The Agricultural Load

LESS than one-fifth of the quarter-million farms in the neighbourhood of public mains in this country is supplied with electricity. Unfortunately, few of the others (many of them under a tenancy) can be connected on a commercial basis, and in his I.E.E. review of electricity in agriculture Mr. H. D. Phelps suggests that the matter must be considered as part of a general farming policy. That much can be done in the meantime is indicated by the low revenue of £10 per farm per annum obtained on an average. One difficulty is to devise a tariff that secures an economic rate for low-load-factor motors without overcharging for domestic use. A reduction in capital charges is, however, the chief aim and the author suggests standardisation of line construction and equipment, propaganda (emphasising the advantages of good wiring methods) and research as to new or better means of using electricity. High-speed motors with V-flat belt drives can be made to serve all purposes and special types of motors (which are mostly single-phase) are quite unnecessary for farm work.

Power Engineers' Salaries

CONSIDERABLE importance attaches to the award of the Industrial Court in the matter of the salaries to be paid to the staff of the Worthing Corporation Electricity Department. It recognises that the employers' side of the National Joint Board is an "organisation of employers" for the purposes of the Conditions of Employment Order and establishes that the terms settled by the Board are the recognised standard for the industry. This means that the application of the N.J.B. Schedule becomes obligatory whether undertakings are members of the District Boards or not. By implication this decision extends to the "lower ranks" of the supply industry, for the Joint Industrial Councils are of the same character as the Boards.

Contracting Industry Wages

WE have already reported that the National Arbitration Tribunal has considered the claim of the Electrical Trades Union that Clause 3 (cost-of-living adjustment) of the electrical contractors' wartime wages agreement should stand, while the National Federated Electrical Association wished to amend it. The Tribunal, having regard to the success of the existing method of settling disputes during the past twenty years or so, suggested that the parties should endeavour to compose their differences themselves, but negotiations have so far proved abortive. The case is now going back to the Tribunal; this is unfortunate in view of the past record and, we may add, a bit difficult for the Tribunal.

Private Generation

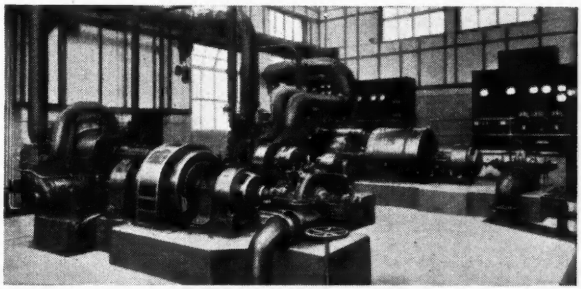
A Survey of Plant Available for Industrial Uses

ONE important result of the present intensification of factory development is the considerable and somewhat sudden stimulus given in some quarters to electricity supplied by private generation. The reasons for this are varied, and there is clearly an urgent need for a survey of the types of plant available for private generation purposes.

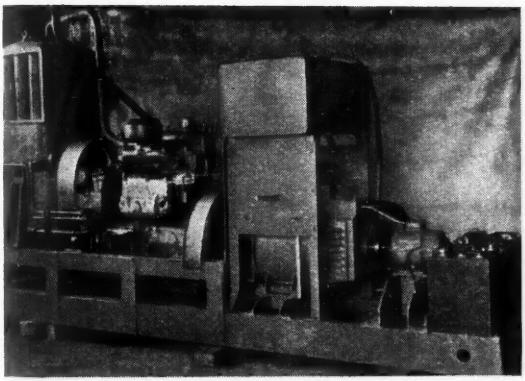
It must be emphasised that no attempt is made here to revive old controversies of public supply *versus* private generation, our sole object being to assist those of our readers who are now being called upon to work in a somewhat unfamiliar field, in preparing for, installing and operating private generation schemes.

What lies behind the incentive to private generation? Looking back to the few years of the commercial development of the grid before the war we see an increasing degree of co-operation by the protagonists of the two systems of electricity supply which has now reached a healthy stage when every bit of machinery is required to work to its maximum production capacity.

An explanation of part of the increase then, is that many private generation plants intended for stand-by purposes only are now augmenting the main source of supply. Another part explanation lies in the essential-process question, for obviously at the present time the proportion of those key industrial processes on the continuity of which depends successful production is much higher than it ever has been.



An outstanding development of recent times is the self-contained turbo-generator; a 250-kW high-pressure self-contained set and a 1,500-kW pass-out turbine set in a textile mill



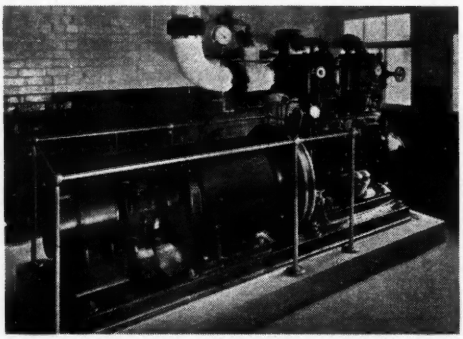
High speed to reduce the space occupied by small sets; 19-kVA, 1,500-RPM self-contained set

Then there are such requirements as gas filtration and aid-raid shelter lighting in connection with which alternative or emergency supplies are obviously desirable or essential.

Our attention has been drawn to many instances where stand-by plant has paid for itself in a very short time when it has been called upon to ensure continuity of supply in industrial premises; and out of such considerations we believe there is a growing recognition among owners of industrial premises that the provision of privately owned generating plant, either as an alternative or as an adjunct to public supply, is desirable.

To review satisfactorily the wide range of equipment available for private generation purposes, particularly the prime movers, some sort of classification seems to be necessary, and we have chosen the method of dealing with the equipment according to the electrical outputs required, namely, large, medium and small, but there is considerable overlapping between these three classes.

The type of prime mover to some extent controls the type of generator to be used.



A back-pressure reciprocating pass-out set in parallel with public supply has automatic regulation of the live steam admitted, the load and the exhaust to process

Where large quantities of compressed steam are available, the motive power is provided by reciprocating engines, or for larger units by turbines. Where no steam is available the drive is usually by oil engines, or where producer-gas can be generated or town gas is available at reasonable cost, gas engines are installed.

The gas-oil engine is an interesting development. It is started up as an oil engine and can either continue to run on oil or be changed over while running to operate on gas, a sufficient quantity of oil being admitted on each working stroke for ignition purposes. The advantage of being able to operate from two separate sources of fuel supply under present-day conditions is evident. Engines operating from sewage gas have also been installed and are running successfully in a number of sewage disposal undertakings.

Again, there are instances of steam and oil driven sets operating together, the steam sets carrying the winter load when the exhaust steam is used for heating, while the oil sets carry any excess load and operate during the summer months when large quantities of steam are not required. Small plants usually consist of either low-speed horizontal engines driven by V-belts or high-speed vertical engines, directly coupled.

When the prime mover is a steam engine the alternator is usually directly coupled and the set runs at from 600 RPM for small machines to 375 RPM for larger units up to about 600 kVA. For outputs above this figure the steam turbine is frequently the prime mover and modern practice seems to favour the geared turbo-alternator running at 1,000 or 1,500 RPM for outputs up to about 2,500 kVA. The turbine itself runs at about 6,000 RPM and thus at a high efficiency.

For the provision of still larger outputs the directly coupled type of turbo-alternator

Cost per kWh generated, 0.373d. ; two 1,000-kW back-pressure and one 750-kW condensing sets

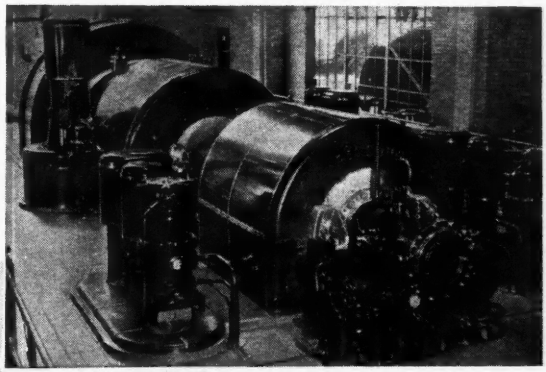
designed to run at 3,000 RPM is now generally the order of the day in a number of industrial establishments. Private generation is frequently justified where steam is required for factory process work by generating electricity as a by-product.

It may be said, however, that for any complete installation for supplying both electricity and process steam, without bias towards either generation or process, a thermal efficiency considerably above, say, 20 per cent., to strike a probable average for electricity generation alone, is attainable. The basic idea, of course, is first to pass the live steam direct from the boiler plant through a back-pressure prime mover, and then to use the exhaust for process work.

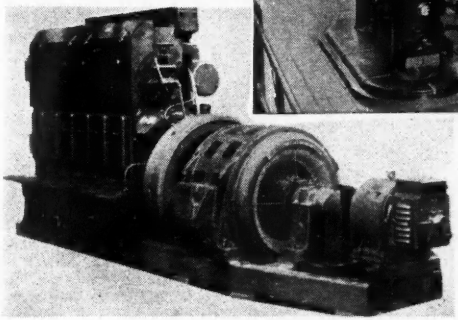
While such a scheme is applicable to all sizes of installations we feel that those interested in the larger kind are primarily concerned and that the steam turbine, which is particularly suited for such installations on the score of output alone, is especially suited to back-pressure work.

The following are some outstanding examples of economies effected in this way. Two 1,000-kW back-pressure turbo-alternators were installed at the factory of a firm of manufacturing chemists, as well as a 750-kW condensing set to provide for out-of-balance heat between electricity generation and process requirements. Live steam was supplied at 350 lb./sq. in. and 650 deg. F., and process steam at 60 lb./sq. in.

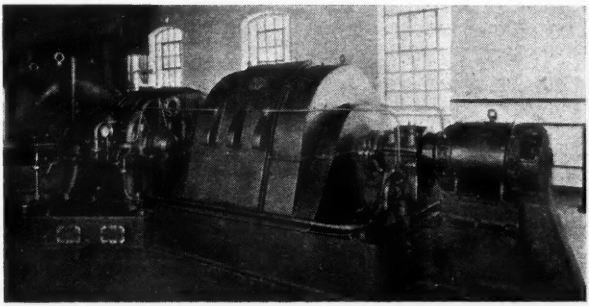
For an early month under normal loading conditions the financial results for the power house were: a total of 18,219,000 lb. of live steam at 17.8d. per 1,000 lb., £1,355; credit for live steam for a fireless loco., £25; credit for



Right: For large outputs the turbo-alternator is now a typical factory installation; a 20,000-kW, 3,600-RPM set has very advanced steam conditions



An interesting Diesel engine development is automatic starting on failure of public supply; a six-cylinder set designed for this purpose



Modern practice seems to favour the geared turbo-alternator running at 1,000 or 1,500 RPM for outputs up to about 2,500 kVA

process steam at 16d. per 1,000 lb., £1,215; balance of live steam for electricity generation, £115; water, maintenance depreciation, wages, etc., £473; cost per kWh generated (292,045 kWh by back-pressure and 12,230 kWh by condensing turbines), 0·373d.; 12,410 kWh from public supply at 0.75d. per kWh; overall cost per kWh. 0.388d.

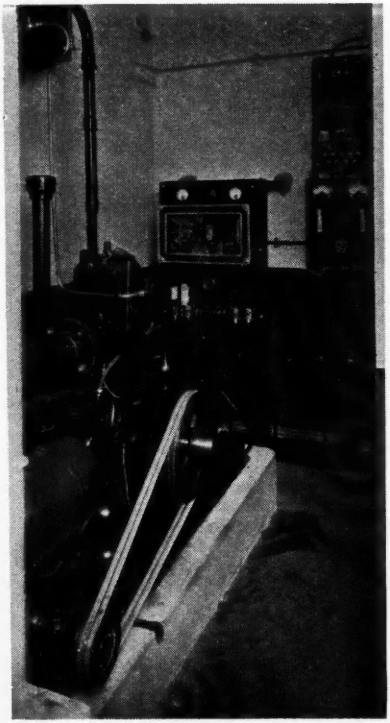
The working costs for a "campaign" (operational season of the year) of a beet sugar factory with two 1,250-kVA turbo-alternators are: total boiler-house costs, £15,672; credit for steam-to-electricity generation, £1,270; total generating station (electricity) costs, £4,077; 178,477,572 lb. of process steam at 19.35d. per 1,000 lb., 3,789,606 kWh at 0.258d. per kWh.

Before the installation of a 300-kW back-pressure turbo-alternator in a textile mill the annual running costs were: 499,820 kWh at 1d. per kWh, £2,082; 4,220 tons of coal at 17s. per ton, £3,587; total cost, £5,669. After the installation of the set the annual costs were: 3,832 tons of coal at 17s. per ton, £3,257; total running costs, £4,268; net annual saving, £1,401; net cost of generation, £681; cost per kWh, 0.327d.

To meet those cases where the heat balance is not constant pass-out plant has been developed to permit the extraction of steam from between the high- and low-pressure elements of the prime mover just as and when it is required for process work, the remainder of the steam passing through the low-pressure system and exhausting either to a condenser or to the works process system.

A 3,000-kW, 3.3-kV, 3,000-RPM directly coupled pass-out turbo-alternator recently installed in a paper mill takes steam at 275 lb./sq. in. and 600 deg. F. and passes out any quantity up to 35,000 lb./hr. at 40 lb./sq. in. A load of 1,850 kW can be carried continuously when no steam is passed out. A butterfly valve in the diaphragm separating the blading into two sections determines the amount of steam that can flow to the low-pressure blading and is operated by an oil relay controlled by the pressure and the pass-out steam and acts in such a way as to keep the steam pressure constant on the up-stream side and the diaphragm whence the steam is withdrawn for process.

A back-pressure reciprocating pass-out set which is arranged to run in parallel with public supply has control gear which prevents the engine from exhausting more steam than can be absorbed in the works at any moment. This regulation is effected automatically solely by the pressure in the process-steam main, and it governs the steam admitted to the engine, and consequently the load, and the quantity of steam exhausted for process, so that the load is varied with the process steam demands. The installation of a 40-HP set of this type at a cost of £1,300 has resulted in a saving of £300 per annum.



The most characteristic development of the small-output petrol- or oil-engine set is automatic control; 5-kW automatic Diesel set for A.R.P. duty

For large outputs the turbo-generator is now a typical factory installation, often directly coupled and similar in many respects to central station plant. A recently built and unusually large industrial turbo-alternator with a loading capacity of 20,000 kW at 3,600 RPM has very advanced steam conditions for factory work. The stop-valve temperature and pressure are 800 deg. F. and 800 lb./sq. in., and the turbine is designed to pass out simultaneously up to 160,000 lb./hr. at 190 lb./sq. in. and 100,000 lb./hr. at 22 lb. sq./in.

Medium Outputs

An outstanding development of recent times in the private-generation field for medium outputs is the self-contained turbo-generator set with the turbine and condenser in one unit and direct driving of the condenser pumps. The

main advantage of this plant lies in the great reduction of installation costs, principally by the elimination of the normal condenser basement, but easy operation and quick starting consequent on the whole of the plant being at floor level are among the other assets.

All that is required in the case of one make is a shallow concrete plinth, in which is incorporated a steel girder framework, and a small pit about 30 in. deep to accommodate the oil tank and the condensate extraction pump. The framework forms the bed of the turbo-generator.

The condenser shell is an integral part of, and is suspended from, the turbine casing, with the exhaust at the outboard end, and the whole is supported from the gear-box at one end and by a flexible support bolted on to the condenser casing. The extraction pump is driven from the low-speed gear shaft on the large sets and from the turbine spindle on the small sets. The circulating water pump is connected by a flexible coupling to an extension of the generator shaft.

Mixed-Pressure Turbines

Another development in the medium output field is the " mixed-pressure " turbine which has arisen out of the practice of developing power by a turbine from the exhaust of an existing engine. The supply of exhaust steam in, say, collieries and steel works is frequently irregular and may even cease entirely at times. The mixed-pressure turbine can, however, automatically admit sufficient additional live steam to enable the load to be maintained when the supply of exhaust steam is insufficient.

The turbine of a 3,450-kW, 2,800-V, 3,000-RPM set normally runs from exhaust steam at 18 lb./sq. in., but it will also take live steam at 150 lb./sq. in. and 405 deg. F. The introduction of gearing in the turbine drive has made a particular contribution to the medium output field where it is often desirable that the speed of the turbine shall not be limited by that of the generator.

Where there are no process-steam and exhaust steam problems to be solved the oil-engine appears to be able to make very special claims, and the Diesel engine has made considerable advance.

A very interesting development with a special bearing on to-day's conditions is the provision for automatic starting on failure of public supply. Two Diesel generating sets which were recently installed for stand-by in a factory where it is of vital importance there should be no stoppage of production automatically start and take up the load within seven seconds. One unit has a seven-cylinder, 300-HP, 600-RPM engine and the other a three-cylinder 130-HP, 600-RPM engine.

The sets are situated in different parts of the works and each is provided with a motor-driven air compressor which automatically starts up when the air receiver pressure falls to 270 lb./sq. in. A high-pressure cut-out is arranged to stop the motor when the receiver pressure reaches 350 lb./sq. in.

The " Comet Head " combustion chamber possesses considerable interest on grounds of economy in that it ensures complete combustion at varying loads. On the compression stroke the air is forced into the combustion chamber through a " throat " which gives it a swirling motion. The fuel is injected into the rotating air which breaks up the fuel spray and thoroughly mixes the fuel and air. The gases pass through the hot throat on the expansion stroke and any unburnt fuel is ignited by the heat of the throat.

Of primary interest in connection with gas engines is the method of governing, of which there are generally two systems—" quantity " and " quality " governing. In quality governing the amount of gas admitted to the cylinder at each stroke is varied with the load, the air quantity being the same in each case; thus the quality of the mixture is altered. A quantity-governed engine takes in varying amounts of gas and air according to the load, the mixture strength remaining sensibly the same at all loads.

Investigations in connection with the introduction of a high-compression gas engine show that while quality governing gives good regulation, the efficiency at all loads below full load is poor when compared with the same engine with quantity governing or running as a Diesel engine, and that for equal compression ratios the results are very nearly the same for a quantity-governed gas engine as for a straight Diesel engine.

Small Outputs

Apart from special considerations such as steam availability, the oil and petrol engine-generator set has a particular province in small output work, and the most characteristic development is in the direction of automatic control, rendering the set particularly suitable for emergency lighting supplies in the capacity of stand-by to either main private generating plant or public supply.

The full voltage or floating battery system is believed to be the most economical for automatic control. The first few lights are taken direct from the battery, but when the demand for current is increased the engine is automatically started by the battery, the set then supplying direct with the battery on charge. When the demand is reduced the engine automatically stops and the battery takes over the residual load.

Two or more of these sets can be arranged to work in parallel, so that when the demand exceeds the output of one set the second set starts up automatically to share the load.

The adoption of high speeds to reduce the space occupied by small sets has been a successful scheme and speeds from 1,000 to 1,500 RPM are being called for on the grounds that

the sets are more readily handled and more economical when overhauls are carried out.

For their co-operation in the preparation of the above survey we are indebted to Ashworth & Parker, Ltd., W. H. Dorman & Co., Ltd., the General Electric Co., Ltd., Lancashire Dynamo & Crypto, Ltd., R. A. Lister & Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., Mirrlees, Bickerton & Day, Ltd., the National Gas & Oil Engine Co., Ltd., C. A. Parsons & Co., Ltd., Petters, Ltd., Ruston & Hornsby, Ltd., and W. Sisson & Co., Ltd.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE 50th County of London Battalion Home Guard, which is composed entirely of personnel of Central London Electricity, Ltd. (Lt.-Col. C. Parker) gave a demonstration and tactical exercise at the Chelsea Royal Hospital Grounds on July 30th. The descriptive commentary was given by General Sir Hubert Gough, who afterwards congratulated the Battalion on its efficiency and enterprise. Following the exercise, the Earl of Lytton (chairman of C.L.E.) accepted, on behalf of the Battalion, from the American Committee for the Protection of British Homes, various weapons presented by individual American citizens; the presentation being made by Mr. Wickham Steed. Among others present were Lord Davies, the Countess of Jersey, Mrs. Parkins-Gauntlet (secretary to the American Committee), Mr. J. M. Kennedy, Lady Gough and Lady Hartnell, Mayor of Chelsea.

The wedding took place at St. Mary the Virgin Church, Shincliffe, Co. Durham, on July 26th, of **Sub.-Lieut. H. Alan Dixon,** R.N.V.R., second son of Mr. William Dixon, M.I.E.E., a partner in the firm of Merz & McLellan, consulting engineers, and **Miss Gladys Margery Burgess,** elder daughter of Mr. W. A. A. Burgess, M.I.E.E., chairman of the North Eastern Centre of the Institution of Electrical Engineers and with A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.

Mr. F. H. Whysall, M.I.E.E., city electrical engineer and general manager at Belfast since 1927, is to retire on March 31st next.

Mr. R. Townend has been appointed chief engineer of the Plant Department of Metropolitan-Vickers Electrical Co., Ltd., in succession to Mr. G. A. Juhlin, who was recently appointed chief electrical engineer. Mr. Townend was educated at the Bradford Grammar School and the Bradford College of Technology. He started his apprenticeship at Trafford Park Works in August, 1903, and before his apprenticeship was over was taken into the Plant Department as assistant to Mr. (afterwards Professor) Miles Walker in October, 1905. On the completion of his apprenticeship in September, 1906, he became a fully fledged member of the Department of which he is now the head. In the years 1917 to 1934, Mr. Townend lectured on the design of electrical machinery to the part-time evening classes at the Manchester College of Technology.

Mr. A. Dunnill, junior mains assistant, Eccles Corporation Electricity Department, has obtained an appointment with the Trent Valley & High Peak Electricity Co.

Mr. C. H. Stafford, general manager of the Leicester City transport system, has been presented with an oak bureau and corner cupboard by the Burnley, Colne and Nelson Joint Transport Committee which has recently been studying the Leicester undertaking, in appreciation of his services to the visiting deputation.

The Council of the City and Guilds of London Institute has conferred the distinction of Fellow of the Institute (F.C.G.I.), on **Mr. J. Rosen,** B.Sc. (Eng.), M.I.E.E., A.M.Inst.C.E.

At the recent annual meeting of the Public Service Transport Association the following members were elected to the Council :—Mr. J. M. Calder (transport manager and engineer, Reading Corporation Transport), Major F. J. Chapple, D.S.O. (general manager, Bristol Tramways & Carriage Co., Ltd.), Mr. P. Coombe, Mr. W. H. Gray, Mr. R. Stuart Pilcher (general manager, Manchester Corporation Transport Department) and Mr. W. Robinson (Brighton Corporation Transport).

Tynemouth Corporation Electricity Committee has released **Mr. A. Smith,** lighting superintendent, to accept a post as civilian mechanist to the Royal Engineers.

Manchester City Council is recommended to extend the services of **Mr. J. Harcourt Williams,** deputy chief engineer, Electricity Department, who is shortly due to retire on superannuation, for a period not exceeding twelve months from October 21st, 1941.

After completing nearly forty years' service, **Mr. H. Hutson,** chief superintendent of the Central Telegraph Office, Calcutta, has retired from service. Mr. Hutson joined the Telegraph Department in 1902 as a signaller. Before going to Calcutta in 1940, he acted as Personal Assistant (Traffic) to the Postmaster-General, Bombay. During the last war, Mr. Hutson served in Mesopotamia.

Mr. L. F. Worthy, area engineer, London Telecommunications Region, G.P.O., has been awarded the M.B.E. for outstanding courage and skill in the work of restoring vital services during and after air raids on the City of London. He has directed all the external work, and while raids were still in progress he regularly visited the men working in the streets.

The Middlesbrough General Purposes Committee has declined to increase the salary of **Mr. F. Lythgoe,** transport manager, by £100 to £1,200 per annum. Ald. Weatherhead, chairman of the Transport Committee, said that when Mr. Lythgoe took over the undertaking there was a debt on it of £210,000 and this had been reduced to £29,000. In addition wages had been increased and fares reduced.

Meter Jewels

Examination, Grading and Reconditioning

Recommendations by the Commissioners' Meter Technical Committee for overcoming the present difficulties of obtaining new jewels and pivots

IN view of the difficulty of obtaining jewels or their substitutes, the Meter Technical Committee, which was set up by the Electricity Commissioners to assist them in the operation of the Act of 1936, has issued some recommendations regarding the utilisation of old jewels and pivots for the reconditioning of electricity meters.

It has been found in practice that in many cases some further years of service can be obtained from jewels and pivots after cleaning and treatment, including re-surfacing when the condition of jewels justifies that course.

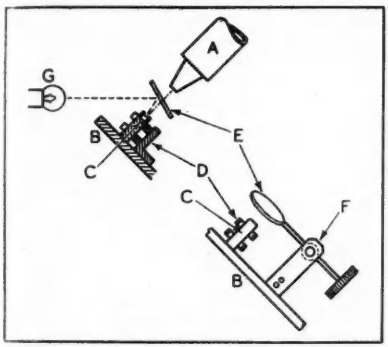


Fig. 1.—First method of examining jewels
A. Microscope. B. Microscope stage. C. Jewel under scrutiny (capable of rotating in "V" guides). D. E. Thin cover glass in frame. F. Universal mounting (ball fitting in spring strips). G. 6-V lamp

It is not to be expected that reconditioned jewels will give the same results as new ones and undertakers may find it necessary to take advantage of the wartime modification allowed by the Commissioners of testing for low-load performance at one-tenth instead of one-twentieth load.

A record should be kept of meters fitted with reconditioned bearings with a view to providing new pivots and jewels when possible. Moreover the work of examining bearings should be placed in the hands of a competent and experienced person. In this connection the services of area meter examiners will be available.

The following methods of examination are recommended :—(1) A microscope with a magnification of 40 to 70 diameters is used, the

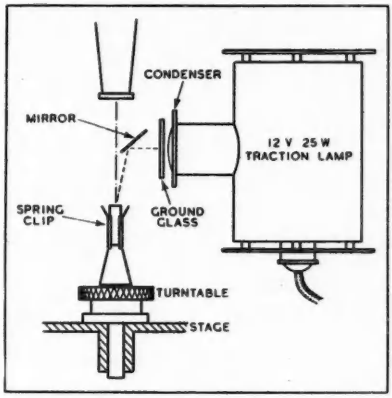


Fig. 2.—Another examination method suggested by the Committee

stage being fitted with a simple means of holding the jewels co-axially with the microscope and automatically positioned with the jewel cup in focus as in fig. 1 and so that they can be rotated and changed easily. The jewel cup is illuminated by a small point of light reflected from a movable surface carried in a universal mounting; and by tilting the mounting and rotating the jewel, the whole surface of the cup is rapidly examined. (2) A

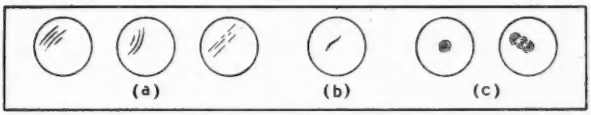


Fig. 3.—(a) Typical surface cracks. (b) Typical scratch. (c) Typical wear (left, central ; right, extended)

long-focus binocular microscope with a magnification of 80 diameters is focused on the jewel, which is held in the fingers in its mount and illuminated by a 60-W pearl lamp in an "Anglepoise" fitting.

By focusing the image of the lamp, and then closing in very slightly, the surface of the jewel shows up sharply. After a short experience, jewels can be rotated and focused by the fingers at all angles without touching the setting of the microscope. Long focus is the essence of the convenience of this method.

In (3) a similar long-focus microscope is used, but the jewel and mount are clipped in a holder which retains it in focus while allowing ready rotation. Light from a 12-V 25-W lamp, fed from a transformer, is focused by a condenser and diffuser system on the jewel almost vertically by means of a mirror set at 45 deg. just outside the line of vision (fig. 2). This method is considered better than (2).

Nature of Defects

Chief defects to be looked for are as follows: Surface cracks, appearing as sharply defined straight or curved lines (parallel if more than one) on the jewel surface (fig. 3a); scratches, from the original polishing or acquired during transport (fig. 3b), of less sharp definition and without the clearly marked direction of surface cracks; wear seen as a rounded area, when due to running mostly at low loads, approximately central in the cup or, when due to displacement of the rotor at higher loads, extending outwards up the side of the cup (the deeper the wear the sharper the boundaries). Effects of wear are shown in fig. 3c.

Other mechanical damage due to rough handling, such as complete or partial fracture, or abrasions, may be found.

Jewels, after examination, should be classified. Grade 1 jewels, which can be re-used immediately, show no defects beyond shallow central wear or scratches outside the possible working surface; Grade 2, which can be re-surfaced, includes jewels with moderate central or extended wear or slight scratches within the working surface area; Grade 3, rejections, includes those with major mechanical defects, surface cracks, deep central or extended wear or deep scratches within the working area.

Pivot Examination

A very flat pivot or the presence of a large amount of oxide indicates considerable wear that would probably make re-surfacing impracticable at the present time. Experiments have shown the advisability of keeping the jewel and pivot from an off-circuit meter paired.

After cleaning, bottom-bearing pivots should be examined for defects under a microscope having a magnification of about 40 diameters. If the pivot end is slightly flat but burnished, it should be slightly trimmed by revolving at, say, 2,000 RPM, and using a piece of Arkansas slip, afterwards polishing with the equivalent of Hubert blue-back emery paper starting with No. 0 and finishing with No. 000. When the pivot end is flat and shows concentric rings, it should be ground until the rings have been removed and to a proper radius and then polished as above.

Grinding and Cleaning

A pivot end that is unpolished and of bad shape must be ground to shape and polished. Pitting usually indicates unsuitable material and little can be done. A highly polished surface with cracks is usually due to extrusion of metal forming a thin skin which breaks away; the metal underneath is usually incapable of being polished by ordinary means. A pivot end should be hemispherical and never ground to a needle point. Diamantine or similar powders should not be used owing to possible abrasive effect of particles left on the pivot.

Even very slight films of grease or dust may obscure serious defects. Washing in benzine, trichlorethylene, carbon-tetrachloride or petrol (with peg-wood scraper if necessary) should be followed by a final rinse in commercial alcohol (not coloured methylated spirit). Boiling in an aqueous solution of sodium hydroxide followed by quick drying and a rinse in commercial alcohol is another alternative.

Lectures on Foremanship

THE Ministry of Labour and National Service in conjunction with the Board of Education and the Scottish Education Department is organising courses of lectures in foremanship at technical colleges in a considerable number of industrial areas. The establishment of a course in any particular locality will be dependent upon there being sufficient local demand. The lectures will cover the following subjects: General principles of foremanship and supervision; principles of production and planning; elements of labour management; and costing and remuneration.

The courses will be normally of 72 hours' duration and will usually be given in evening meetings of two hours each, held twice a week. No allowances or expenses will be paid by the Ministry to students, but they will not be charged fees for the course.

It is appreciated that both personality and considerable technical experience are required to make a foreman and that it is impossible to produce one simply by a course of lectures. The intention of the courses is to give the wider background which will be useful to men already possessing these qualifications. On this account only existing foremen and other men with the necessary experience will be accepted. Employers are invited to put forward men of this type whom they consider will benefit from taking the course. Employers and workpeople interested in the scheme should get into touch with their local Employment Exchange.

An examination will be held at the conclusion of each course and a written statement will be given by the technical college to those who pass it to the effect that they have attended the course and passed the examination successfully.

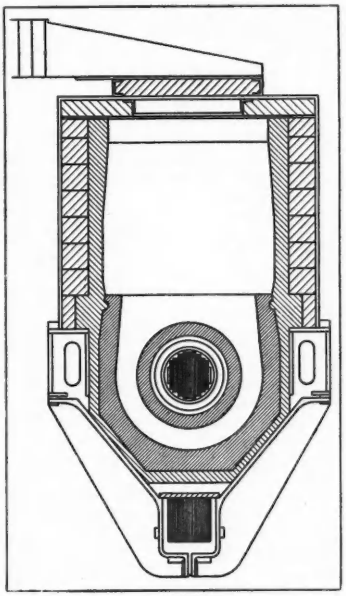
Induction Furnaces

Construction and Operation of Low-frequency Types

By A. L. Morris, A.M.I.E.E.

THE use of electrical energy as a medium for the refining and melting of metals has much increased during recent years. Great impetus has, therefore, been given to the design and development of electric furnaces and the basic principles of electricity have been explored in order to obtain effective transformation of electrical energy into heat. The outcome has been the arc, the resistance, and the induction furnaces.

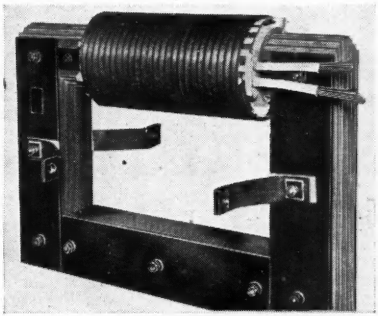
Of the latter, two types have come into use, viz., the high-frequency or coreless induction furnace and the lesser-known low-frequency or iron-core induction furnace. The high-frequency furnace requires electrical energy at 500 to 2,000 cycles, and the charge is melted by eddy current action. On the other hand, the low-frequency furnace operates at 50 cycles and functions as a transformer whose secondary winding is short-circuited.



Section through induction furnace

In the low-frequency induction furnace (the patent rights of which are held by High Duty Alloys, Ltd.) shown in section, part of the charge occupies an annular ring round the outside of the exciting winding. It thus acts as a short-circuited turn, through which the secondary current circulates. The primary, or exciting winding, is wound on one limb of a single-phase transformer core, around which the furnace is built up.

Class "B" insulation is essential for the



Induction furnace transformer (High Duty Alloys, Ltd., and Johnson & Phillips, Ltd.)

construction of the transformer, owing to the high temperatures experienced. Asbestos is chiefly used, but the new glass tapes and fabrics are finding increasing employment. Even with this heat-resisting insulation, air-blast cooling is often necessary to avoid too high a temperature. The transformer and its winding must be robust. A breakdown of the furnace lining ought not to irrevocably damage the winding insulation. Incipient short-circuits between turns due to splashing of molten metal are also to be avoided. These furnaces are not self-priming, and require either an initial charge of molten metal or some form of auxiliary heating. Once they are in operation they are run continuously until a new lining is required.

As would be anticipated from a knowledge of transformer practice, the leakage reactance between the primary and secondary is high. This results in a low power factor of operation —about 0.3 to 0.4, depending upon the nature of the charge. Power factor improvement by static condensers is, therefore, standard practice.

Control of the heat is effected by variation of the exciting pressure to the furnace. The

simplest method is to employ a tapped auto-transformer; the number of tappings depends upon the degree of control required, but two or three "trickle" loading tappings must be provided. These low-voltage tappings enable the charge to be maintained in a molten state during week-ends or holidays; if the charge were to solidify, the furnace would be ruined unless auxiliary heating were available. The low-frequency induction furnace thus offers a number of advantages over other types for melting non-magnetic metals. It scores over the resistance furnace by having all the heat generated in the charge itself and, unlike its high-frequency counterpart, no special motor-generator set is necessary.

Parliamentary News

By Our Special Reporter

Cost of Power and Coal

IN the House of Commons on July 29th Mr. A. Edwards asked the Chancellor of the Exchequer if he was aware that the cost of electric power had been increased by 40 per cent. due to increases in cost of coal; that the effect of this was to inflate the cost of nearly every commodity purchased by the Government; and at what date he proposed to carry out his undertaking to subsidise rising costs of coal, power, &c., in order to stabilise prices and wages.

Sir Kingsley Wood said that the Minister of War Transport was not aware of any general increase to the extent indicated, but he would ask the Electricity Commissioners to look into any cases which Mr. Edwards had in mind. Among the measures taken in relation to the charges of public utility undertakings, the Commissioners had informed all electricity undertakers that no further increases in electricity charges (other than increases already announced) should be made without the undertakers first submitting their proposals to the Commissioners, with necessary supporting data, so that the Minister might have an opportunity of considering the position.

Coal for Public Utilities

Mr. D. Grenfell, Secretary of Mines, replying to Mr. Culverwell, said he could not give an absolute guarantee that all public utility undertakings could be supplied with coal enough for the next six weeks. The average amount of coal in stock by public utility undertakings, gas, electricity and water, ran to about six weeks' supply at the summer rate of consumption, but these stocks were not evenly distributed and there were a number of them which did not hold a fortnight's stock at the present time. There had been a marked increase in the rate of stocking by public utilities—notably gas works—in the past few weeks.

Mr. Grenfell added that no public utility undertaking had been stopped owing to lack of coal since the war began. It was impossible to convey coal in the desired quantities to the various parts of the country. They were trying to build up and make good the stocks in those places where they were lowest. He hoped to be able to report very soon that those stocks would be raised to the average level commensurate with the stocks prevailing generally throughout the country.

The Central Register

Mr. Crowder asked the Minister of Labour how many electrical engineers had been placed through the instrumentality of the Central Register since September, 1940, and the cost per placing.

Mr. Bevin said that the number of electrical engineers placed through the medium of the Central Register between October 1st, 1940, and July 26th, 1941, was 404. He was unable to give the cost per placing.

Power for Factories

On July 30th Mr. A. Edwards asked the Parliamentary Secretary to the Ministry of Supply if he was aware that whilst instructions for new factories went forth, his department was not making adequate provision for electrical power to run them; and what steps he proposed to take to see that certain districts did not become unbalanced with regard to power demand and supply.

Mr. H. Macmillan said that the provision of electrical power was not the responsibility of the Ministry of Supply, but the availability of such power was one of the first considerations which was taken into account, in consultation with the Electricity Commissioners and the Central Electricity Board, before finally deciding upon the location of new factories.

Mr. Edwards: "Will the Parliamentary Secretary take it from me that this is not being done and that a serious situation has arisen?"

Mr. Macmillan: "Provision has been made in full measure, but I would not like to give details of the steps that have been taken."

The Black-out

Sir Henry Morris-Jones asked the Home Secretary whether consideration was now being given, in consultation with the Royal Air Force, to the question of any modified system of

lighting in the coming winter, bearing in mind the effect of a complete black-out on morale and public health and on production; and whether any improved plans were in contemplation for a more efficient ventilation of all industrial premises which were in use after dark.

Mr. Mabane, who replied, said that the question of lighting was under constant review in consultation with the Royal Air Force, but there were at present no grounds for making any change in the systems and standards now in force and based on the experience of the past. Special attention had throughout been given to the requirements of production and undertakings of national importance. Ventilation in factories was a matter for the Factory Department of the Ministry of Labour and National Service rather than for him, but he was informed that defects in ventilation due to improvised black-out arrangements in the early days of the war had now been largely remedied.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Chief Engineers' Salaries

AFTER a long period of constructive work and patient negotiation the Association representing the municipal chief electrical engineers of the country last month signed an agreed scale of salaries and set up a National Joint Board of engineers and employers to administer the schedule and conditions of employment.

When the negotiations were nearing completion there arose a frantic effort by one or two men to try and wreck the work of years by making statements through the medium of the electrical Press so utterly incorrect that even Dr. Goebbels will have to look to his laurels. This action is now capped by an appeal to other engineers to get together to form a new association to do all those things which the chief electrical engineers' Association has now accomplished.

One does not like to damp youthful enthusiasm even if misdirected, but negotiating a salary schedule is not child's play. To get one adopted presupposes a cheerful giver on the other side and they are scarce indeed! Again, the available engineer negotiators for this breakaway association will be very scarce also, for the chairman of the National Joint Board, Alderman Walker, has stated in the Press that the employers had verified that the existing Association represents about 90 per cent. of the possible membership.

It is certain that many of the remaining 10 per cent. of engineers who are not in the existing Association would not link up with the proposed new one. Some of them are of the type who rely on the work of others and are chary of paying contributions unless they can feel assured of a good monetary return for their outlay. Such men are not likely to make disinterested pioneers to form the nucleus of a rival association. The only ones who might respond to the appeal are the few men whom the majority of municipal electrical engineers reckon outside the pale because they sought personal advantage at the expense of their more public-spirited colleagues.

One can understand such men seeing the red light when their colleagues within the Association are within sight of getting recognition of those things for which they have striven. It would also explain the venom of the attack and the desire to launch even a forlorn hope such as a breakaway association if thereby they could form one of a small crowd and not stand in conspicuous isolation.

JOHN H. PARKER,
Member and Past President
*London, S.W.*1. of E.P.E.A. & A.M.E.E.

Earth Leakage Protection

REGARDING Mr. T. C. Gilbert's letter in your issue of July 25th, the primary consideration in developing the system described was to obtain relative freedom from shock and fire risk. I do not consider risk of damage to the tool a serious reason for the unsuitability of ordinary earthing.

If a tool develops an earth fault on any part the damage is limited to that part and it is due for replacement anyway. Sometimes the affected part may be salvaged, but owing to the small value of parts used in portable tools, even this is rarely good economic practice. In the few cases where a " splash " is formed on a casting, a few rubs with a file and emery cloth restore it to working condition. In practice the amount of additional damage to portable tools compared with those due to failures with ordinary earthing is negligible.

The interposition of the double-wound transformer would not of itself give the same degree of protection. The mains voltage could get through to the secondary in the event of interwinding failure. This would be undesirable, whether the secondary were earthed or not. Also in the event of one or more earth faults, overcurrent protection would have to be relied on and might then only clear one of the secondary lines, instead of completely isolating the whole transformer. The use of a double-wound transformer is not always

necessary where the neutral or mid-point of transformer or generator is available.

Mr. Gilbert asks for a method of detecting discontinuous earth conductors. In specially dangerous situations, where proper maintenance and the method of using a lamp described in "Electrical Accidents" for 1937 are not considered sufficient, a small push-button is fitted to the apparatus and tests made as frequently as considered desirable. Even a high-resistance joint or a single strand will pass enough current to operate the trip.

I am at present working on a system for use in conjunction with the one under discussion which is designed to cut off the supply in the event of a broken earth conductor in the flexible cord, but it is doubtful if it would have a wide field of application. The connection of the trip coil in an insulated earth lead also gives no protection against a broken earth conductor in the flexible cord; in fact, the test button gives a false sense of security.

If by "orthodox manner" Mr. Gilbert means one or more of the various ways of connecting the trip coil in the earth lead to the apparatus and using insulated earth conductors between the coil and the apparatus, I do not agree with the view expressed in his last paragraph. Judging by the regulations I am far from being alone in realising its weaknesses which are overcome by the method I advocated, viz., risk of shock if the trip fails to operate, burns out or becomes open circuited, or during the time taken by the trip to operate, in addition to change of earthing practice necessitating the education of installation and maintenance staff.

First, Mr. Gilbert wants to omit the trip and then the transformer. This leaves only the germ of the idea and the wiring, which brings us back to ordinary earthing. The transformer cost is not usually important bearing in mind the increased safety secured.

Slough, July 28th. F. E. BUTCHER.

New American Plant

100,000-kW Extension at Burlington Station

LAST October a 100,000-kW extension was carried out at the Burlington station, which supplies the southern area of the Public Service Electric and Gas Co., New Jersey. Previously the plant installed had consisted of an 18,000-kW turbo-alternator supplied with steam at 650 lb. per sq. in. and 850 deg. F. superposed on three 200-lb. units making the total capacity 55,000-kW.

In the new installation, which is described in *Power* for July, is included a 100,000-kW (most economical rating) cross-compound turbine designed for initial steam conditions of 1,250 lb. per sq. in. and 950 deg. F. with high- and low-pressure elements of equal capacity both running at 3,600 RPM.

The h.p. element is a double-shell fourteen-stage impulse machine from which steam at 100 lb. per sq. in. is taken to double-flow tandem turbines exhausting to a single-pass 55,000-sq. ft. condenser placed parallel to the axis of the machines.. A five-stage regenerative feed-water heating cycle is employed with two extractions from the h.p. turbine, one from the cross-over connection and two from the l.p. turbines.

The interchangeable 13-kV generators are normally operated as one unit and at full load carry 54,000 and 46,000 kW for the h.p. and l.p. elements at 80 per cent. power factor when running in hydrogen at 0.5 lb. per sq. in. pressure and with cooling water at 86 deg. F. in summer. With hydrogen at 15 lb. the combined rating is 125,000 kW (divided equally) at 87.5 per cent. power factor.

Steam is provided by two boilers with an output of 550,000 lb. per hr. each at 1,350 lb. per sq. in. and 950 deg. F. Constant steam temperature over a wide range is obtained by a gas by-pass of the convection superheater.

Maximum radiant heat absorption has been the aim in the design of the furnace, the primary and secondary sections of which are separated by a slag screen open at the lower end. Water walls of the primary furnace consist of partly studded tubes with plastic chrome ore between studs, while the secondary is made up of bare tangent tubes. Floor-tubes are covered with cast-iron blocks protected by a layer of chrome ore. Slag drips continuously through a water cooled opening near the centre of the floor.

Down-shot burners in the arch of the primary furnace are arranged to fire either pulverised fuel from two double-classifier Hardinge mills or oil from twelve mechanical atomisers. For starting up, four small air-atomising oil burners are employed. Electrostatic precipitators are installed between the outlets of the air heaters and the inlets of the induced-draught fans.

Auxiliaries (5,100 kW at full load) are supplied through two 4,000-kVA 13.2/2.3-kV three-phase transformers, one connected to the generator bus-bars and the other to one lower-voltage winding of 13.2/132-kV system step-up transformer. Motors under 100 HP are wound for 230-V.

A theoretical heat balance based on guarantees with 5 per cent. allowed for losses indicates a heat rate of 10,680 BthU per kWh sent out.

Reactive Current and Power Factor

The need for realising that A.C. quantities are measured in terms of average values

A Discussion of Basic Ideas

By
G. W. Stubbings,
B.Sc., A.M.I.E.E.

THE terms "current" and "voltage" are really equivocal in character when applied to AC circuits. Considered singly and quantitatively, they refer to the square roots of average values. RMS values of current and voltage have nothing to do with phase angle or power factor. The latter ideas involve that of the actual variation of instantaneous values. The measures of physical quantities in AC circuits are average values. Phase angles and power factors are numerical ratios. The basic quantity in an AC supply is the average value of the instantaneous power, and RMS current and voltage values are really the square roots of average power values—in the case of current, the power loss when this flows in 1 ohm, and in the case of voltage, when this is applied to a resistance of 1 ohm.

"Average Power"

Power in a simple two-wire AC circuit is alternating at twice the supply frequency; it has a phase angle relatively to the voltage which produces it, but fortunately this is not of practical relevance and the student is not confused by the idea of the power factor of power. The quantity "average power" is of basic importance because it is a measure of what is actually and commercially utilised, and because it is indicated by measuring instruments.

The distinction between the average values of electrical quantities in AC circuits and the time characteristics of their variation relative to each other is responsible for a good deal of confusion of thought relative to the idea of power factor and the derived idea of wattless current. Engineers are continually rediscovering the fact that what is conventionally called a wattless current is continually carrying power, and that what is called the reactive component of an alternating-current has no objective existence.

The basic definition of power factor is the ratio of average watts to the product of RMS amperes and volts. This product is called the VA. When current and voltage variations are both sinusoidal, the VA is numerically equal to the amplitude of the instantaneous power variation about its average value. With constant VA a change of power factor changes the average value but does not alter the amplitude of the power oscillation. If the power factor is unity, the direction of energy flow never reverses, and the average power value is equal to its amplitude. As the power factor falls to zero, the average power value similarly falls, and in one cycle of power change the forward and backward flows approach equality.

A current at zero power factor is called "wattless," not because there is no power associated with it, but because the net transfer of energy over a cycle of change is zero. The term "wattless" as applied to an alternating current is not strictly correct, but, as its use is now firmly established and as it connotes a correct idea, it is futile to object to it now.

With sinusoidally varying current and voltage, power factor is equal to the cosine of their angle of phase difference. This leads to the idea that a current of power factor less than unity is equivalent to two component currents, flowing simultaneously, the one, the active current, carrying the whole of the average power and therefore of unity power factor and in phase with the voltage, and the other, the reactive current, which is of zero power factor and wattless. As the resultant of two sinusoidally varying quantities of the same frequency is a third sinusoidally varying quantity, the characteristics of which can be determined by the usual vector construction, this idea of the resolution of a current into active and reactive components is a legitimate fiction. It has the great advantage that it is a convenient way of making AC circuit calculations.

Only One Current

It is further to be noted that it is possible very approximately to construct, and exactly to conceive, two parallel circuits which will produce a resultant current equal in magnitude and phase to any stipulated alternating current and in which the active and reactive components appear physically and objectively separate. But this does not alter the fact that in a circuit composed of a single inductive component, and taking a lagging current, only one current flows

in response to the applied voltage, and that the production by the same voltage of two simultaneous currents in the one conductor is an idea which has no objective sanction.

Attempts have been made to get over this difficulty by rejecting the idea of active and reactive current components, and considering the total voltage to be the resultant of two components, the one overcoming the resistance of the circuit and in phase with the current, and the other, overcoming the e.m.f. of self induction. This conception, on the face of it, seems to be more reasonable than that of current components, because the effect of inductance in a circuit is a restriction of the current flow, additional to that of resistance. Further, it is possible to construct approximately and to conceive exactly a circuit composed of separate resistances and pure inductance components, of the same impedance characteristic as any given circuit, and in which these two voltage components will appear as objective potential drops.

Resistance and Inductance

In spite of this, however, the component voltage idea is, on reflection, no more satisfactory than that of component currents. In ordinary inductive circuits, resistance and inductance are not separate but are inextricably mixed up. The whole voltage is applied to the whole circuit, and it is just as artificial to think of one component of this voltage being applied to the distributed resistance and the other to the distributed inductance, as it is to think of one voltage producing simultaneous currents in one circuit. There seems to be no escape from the conclusion that active and reactive components, whether of current or voltage are, considered in respect of simple circuits, mere mathematical fictions, and have no objective reality.

It is well known that the idea of three-phase power factor cannot be developed from the idea of phase difference of currents and associated voltages because this will lead to the anomaly of a power factor less than unity in a supply to devices composed of pure resistances. The idea of three-phase power factor must be built up on the conceptions of the total power and the total VAr consumption of the load, and on this basis, the rational character of which is shown by the fact that instrument readings lead to it, three-phase power factor is the cosine of the angle whose tangent is the ratio VAr/W.

Simple Two-wire Circuits

In simple two-wire AC circuits with sinusoidally varying currents and voltages, the conception of the solution of VA into watt and VAr components has much more objective reality than the analogous resolution of current into active and reactive components. The significance of AC watts is unequivocal; we have already seen that VA is equal to the amplitude of the power oscillation, and the quantity VAr is a measure of the magnetic or capacitative energy stored in the circuit per half-cycle of power change. Each of these quantities, therefore, has an objective reality.

This idea can be illustrated more definitely by the aid of a little mathematical symbolism. The watts W in an AC load can be given by a unidirectional power flow the instantaneous value of which is $W \cos 2\,pt + W$. The VAr represents a purely oscillatory power flow represented symbolically by $(VAr) \sin 2\,pt$. When these two power flows occur simultaneously their resultant will be:

$$W \cos 2\,pt + (VAr) \sin 2\,pt + W$$
$$= \sqrt{[W^2 + (VAr)^2]} \cos (2\,pt - \phi) + W$$
$$= VA \cos (2\,pt - \phi) + VA \cos \phi$$

and this is the ordinary expression for instantaneous power in an inductive circuit. Equal reactive and capacitative VAr are, at every instant equal in magnitude and opposite in direction, so that when they appear in one circuit they cancel to zero.

The notion of power factor in circuits with dissimilar wave forms of current and voltage is more complicated, and it involves the subsidiary ideas of displacement factor and of a second wattless component due to harmonics. These ideas are outside the scope of this article, the purpose of which is to discuss basic ideas of power factor in the simplest kind of AC load. The conclusions arising from this discussion are the need for the realisation that physical quantities in AC circuits are measured in terms of average values, and that it is better to develop the power factor idea in terms of VA, watts and VAr than of the fictitious notions of active and reactive components of current or voltage.

Dielectric Loss in Dipolar Solids

IN a new E.R.A. Report the dielectric loss of a dilute solution in solid paraffin of long chain molecules, containing dipoles, is investigated theoretically. In such substances, the interaction between dipoles is negligible and they thus follow the Debye theory. In order to account for the time of relaxation, the structure of these substances is investigated, and it is shown that only the case where the dipole-containing chain molecule is shorter than the paraffin molecule can be expected to yield simple results.

Calculation is made of the dependence of log time-of-relaxation on the chain length, and good agreement with experiments, as far as available at present, is obtained. Copies of the Report, Ref. L/T121, " Dielectric Loss in Dipolar Solids. I—Solutions of Dipolar Molecules in Solid Paraffins " (by H. Frohlich), may be obtained from the British Electrical and Allied Industries Research Association, 15, Savoy Street, London, W.C.2, price 11s. 9d. post free.

Ships' Coupling

Reversible Magnetic Design

THE principle of magnetically coupling oil engines to the propulsion shafts of ships is well known, as is also the fact that hitherto it has been necessary to reverse the engine in order to change the direction of rotation of the propeller. Avoidance of such manipulations is now possible by a design provisionally patented by the General Electric Co., Ltd., which is advantageous in maintenance and other respects.

Since the action is similar to that of an induction motor, if three-phase excitation is provided for the engine member of the coupling instead of DC, the connections can be such as will create a rotating field in the opposite direction to the rotation of the engine. The three-phase frequency must be twice that corresponding to the engine speed, so as to produce a rotating field of twice normal speed backward with regard to the engine member. With the latter revolving forward at its normal rate, the speed of the field in space will be the normal backward; as the rotor will follow this field, the propeller will be reversed at normal speed in the astern direction.

Dual-Purpose Winding

It is necessary to design the winding of the engine member of the coupling for both DC (ahead) and AC (astern) excitation. For this purpose the internal salient poles are replaced by a laminated core, slotted to take a star connected three-phase winding. When excited with DC it may be fed through two phases in series, the other being idle; or through two phases in parallel connected in series with the third phase.

Alternating current for excitation may be obtained from an alternator embodied in the coupling in the form of a number of salient poles arranged on the outside of the engine member, and a three-phase stator outside these poles, separated by an air gap. The engine is run at full speed and the outer poles are excited with DC, the stator winding then producing a three-phase voltage which is applied to the inner exciting winding. Since the frequency of the alternator is double the original frequency, the number of poles needed for the outer exciting winding is twice that for the inner exciting winding.

The rating of the alternator requires some consideration, since there appears to be an internal circulation of power. Half the electrical output from the alternator is converted into mechanical power for the propeller and the other half is converted into mechanical power to drive the engine member. The latter half assists the engine power to provide a total to drive the alternator, which must, therefore, provide full power at half speed, so that its rating is equivalent to twice the rating of the engine.

But the alternator need not be so disproportionately large, for the duration of a full torque reversal is usually very limited, so that a short time rating can be used. Also increased propeller torque can be obtained by altering the ratio of the number of poles of the two windings.

Method of Control

Control is as follows: Start the engine up to its minimum speed, then apply DC to inner exciting winding, when propeller and engine can be speeded up as desired. For reversing, switch off DC, reduce engine speed to the minimum, connect stator winding to inner exciting winding, apply DC to outer exciting winding and, the propeller having reversed, the engine can then be speeded up again.

To connect the stator to the inner exciter for astern and disconnect them for forward running would require a large switch. To avoid this the inner exciting winding is divided into two separate parts, one of which is permanently connected to the stator winding and the other is excited with DC for forward running, in which circumstance the first inner half is inoperative. But when reversed, both halves are excited, the AC field so "cutting" the second inner half as to induce in it a voltage considerably greater than the normal. To avoid this both inner exciting halves are wound with different numbers of poles, six and eight, which are mutually non-inductive.

Alternator Mounting

When two or more couplings are geared to the same propeller shaft, mounting the alternator on the outside makes the overall diameter rather large; alternatively, it can be mounted on the engine shaft by the side of the coupling, introducing a bearing if necessary. Overhanging weight can be reduced somewhat by inverting the coupling members themselves, so that the squirrel cage element is driven by the engine without in any way altering its characteristics.

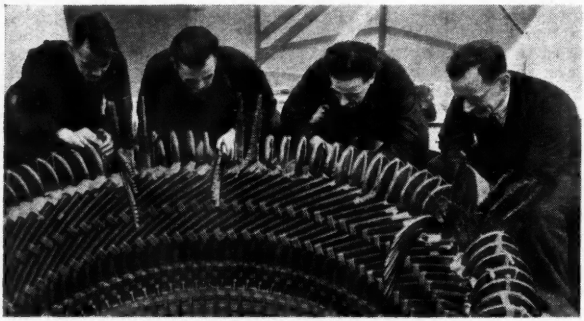
The exciting alternator is seldom used, being idle during forward operation; it can be short-time rated for limited astern duty and, therefore, smaller than would be needed for Diesel-electric propulsion, the efficiency of which is said to be materially lower than that of magnetically coupled oil engines, while heavy current switchgear is not necessary, only two field switches and two regulators being required.

Engineering Training

Brush Company's Scheme Reorganised

RECOGNISING the importance of continuing and developing training facilities for engineers so as to ensure a healthy post-war engineering industry, the Brush Electrical Engineering Co., Ltd., has recently reorganised its apprentice training programme, details of which are given in a new illustrated booklet " Engineering as a Career " published by the company.

The programme is a comprehensive one, divided into four main groups:—(1) Trade apprentices; (2) student apprentices; (3) college apprentices (sandwich system and post-graduate); and (4) vacation apprentices.



Apprentices working on a stator

Scholarships (value £75 per annum), tenable for four years, are awarded by the company to enable students of limited means to take advantage of the excellent training afforded by the Brush college apprentice sandwich course. The first year is spent at the company's works and the remaining three at any British university. After taking their degree, scholarship holders return to the company's works for a final year of apprenticeship, during which they rank as second-year college apprentices.

Trade apprentices, who are drawn principally from senior or central schools and junior technical schools, are normally accepted between the ages of 14 and 16, in the first instance for a probationary period of three months, and from the age of 16 until 21 they receive a detailed training in the trade selected, under the control of an apprentice supervisor. All must attend regularly at least two evenings weekly at Loughborough College during the winter sessions, and the company pays a bonus of 2s. a week to those who make 90 per cent. of the fullest possible attendances and whose progress and conduct are satisfactory. Although the trade apprentices may start with the initial intention of becoming a fitter or machinist it is possible for youths to progress to one of the design offices or the higher administrative posts.

The student apprenticeship course is intended for boys who enter industry immediately after passing matriculation or an equivalent examination and provides for practical training to run concurrently with their studies for the graduateship examination of the I.E.E. or I.Mech.E. For this course a premium of 150 gns. is required, payable in three instalments, which is refunded in the form of pay during the first three years of apprenticeship. The reason for requiring a premium is that during the early stages of his course the student apprentice is transferred from department to department as soon as he has acquired an understanding of the processes and before he has really contributed to the departmental output.

The college apprentice course is for two years and is for post-gradautes, to give them the practical training required as one of the qualifications for associate membership (I.Mech.E. or I.E.E.). Subsequent to the two years' apprenticeship every effort is made to give opportunities for obtaining the further two years of training and responsible experience on which the Institutions insist. College apprentices may do the first year of their apprenticeship immediately after leaving school and before they commence their university course; this is the sandwich system, which is becoming increasingly popular. During the winter months a programme of lectures and discussions is arranged for student and college apprentices.

A limited number of vacation apprentices are taken each summer for a short course lasting six weeks. Training is mainly in the machine shop and fitting sections. A series of tours of the works is arranged, the products and processes being explained, and special lectures are also given by senior members of the staff.

The booklet also outlines facilities for further training and advancement after apprenticeship, Brush sports and social activities, and includes a brief review of the company's history.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Midget Hand Drill

FOR close hand drilling in wood and metal on a production basis in factories a conservatively rated "Midget" machine (model 806-808) is announced by the CONSOLIDATED PNEUMATIC TOOL CO., LTD., Fraserburgh, Aberdeenshire. Ventilation of the universal motor is unusual in that the air intake ports are at the end of the handle where they will not pick up chips

Well-ventilated drill for wood and steel

and dirt, and are less likely to be restricted by the operator's hand. The exhaust air is blown over the gear case towards the work, thereby tending to keep the whole tool cool and clean.

The pistol-grip switch mechanism is accessible for removal and the switch and stator housings are separate castings; thus a blow on the switch handle will not distort the bearing alignment, since the upper armature bearing is mounted in the stator housing. Both switch trigger and shape of the handle are convenient, while the cable clamp permits renewal of the connector without disturbing the switch.

One pair of helical gears is provided; all ball bearings are mounted in steel inserts, cast in place, not in aluminium seatings; there is a separate holder for each brush, held in varnished fibre mounting. The standard model is available for 3,500 and 5,000 RPM with a drilling capacity up to $\frac{1}{4}$ in. holes in steel; the speed of the $\frac{1}{4}$ in. model is 2,500 RPM. The tool weighs $3\frac{1}{4}$ lb., it is $7\frac{1}{8}$ in. long and the spindle offset of $\frac{3}{4}$ in. enables it to work in reasonably confined space.

Sound Reproduction

The modified and improved version of the "Microgram" equipment offered by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, embodies a three-stage low-frequency amplifier with microphone and gramophone inputs, an induction gramophone motor, a moving-iron armature pick-up, a transverse-current type microphone and 50 ft. of connecting cable, all within a portable oak table type cabinet measuring $20\frac{1}{2}$ by 17 by $13\frac{1}{2}$ in. The "Osram" valves employed are an MH41 resistance-capacity coupled to an MH4, which is transformer coupled to two PX25 arranged in push-pull in the power stage; the high-voltage rectifier is an MU14.

Dual input circuits permit the use of either microphone or pick-up, either independently or mixed, and both inputs can be independently regulated by volume controls on a small panel let into the front of the cabinet. The only other control is the mains switch. The maximum output is 14 W and low impedance speakers of either 15 or 7.5 ohms may be used. Polarising current for the microphone is supplied by a special circuit incorporated in the amplifier; thus the need for external batteries or other external DC sources is obviated. Normally the microphone is resiliently mounted on a neat handgrip, but it is easily detachable for use on a table or floor stand.

Useful Griller-Boiler

The latest cooking appliance to be announced by L. G. HAWKINS & CO., LTD., 30, Drury Lane, London, W.C.2, is a serviceable "Supreme" griller-boiler, the dimensions of which are about $18\frac{1}{2}$ in. by 11 in. by 8 in. high. It has one radiant boiling ring of 1,000 W loading and one grill element of 800 W, controlled by separate on-and-off switches.

The grill chamber is approximately $10\frac{1}{2}$ by $10\frac{1}{2}$ by $5\frac{1}{2}$ in. high and is fitted with a door, so that it may be used as a small oven. Above the grill element is an unusual sliding cover, which permits the chamber to be totally enclosed while pots are simmering on top. If less heat is needed within the grill chamber, the cover can be slid away from the element, so leaving it open for boiling and frying. A large grill pan is supplied and an earthing terminal is provided.

"Supreme" 1,800-W griller-boiler

The finish is black on top, while the sides and other parts are attractively cream enamelled. The modest price is subject to purchase tax, but this appliance is declared not to be affected by the Limitation of Supplies Order.

China's Import Trade

Japanese Domination

LAST year the electrical import trade of China continued to show an increase in spite of internal disturbances. The additional trade was, however, mainly done by Japan. American business was maintained, but as was to be expected in view of the war, the share of the United Kingdom dwindled.

There is no doubt of the vast potential demand for plant and material, not only for the development of the areas to which General Chiang-kai-shek and his followers have retired, but also the reconstruction of industry in the districts damaged by the fighting and air raids. Meanwhile, Japan controls the means of supply and transport almost completely.

The accompanying figures have been extracted from the recently-issued returns of the Chinese Maritime Customs. They show the values of the imports of the principal electrical classes in 1940, with notes of increases or decreases compared with 1939. (The gold unit was valued at about 3s. 4d. in 1940.)

	1940 Gold units (thousands)	Inc. or dec. as compared with 1939
Dynamos and generators and parts—		
Total	252	+ 88
From Germany	12	+ 2
,, United Kingdom	8	− 11
,, United States	22	− 35
,, Japan	96	+ 83
Electric motors and parts—		
Total	1,035	−105
From Germany	320	+ 46
,, United Kingdom	123	−188
,, Japan	496	− 69
,, United States	44	+ 18
Transformers and parts—		
Total	440	+ 70
From Germany	17	− 8
,, United Kingdom	47	+ 23
,, Japan	271	+ 7
,, United States	6	+ 2
Electrical machinery, unspecified—		
Total	848	+358
From Germany	49	− 8
,, United Kingdom	201	− 25
,, Japan	485	+272
,, United States	61	+ 20
Electric lamps and lampware—		
Total	546	+329
From Germany	3	− 7
,, United Kingdom	9	+ 6
,, United States	5	− 1
,, Japan	257	+110
,, Belgium	265	+219
Electric fans and accessories—		
Total	17	− 39
From United Kingdom	3	− 6
,, United States	3	− 9
,, Japan	7	− 20
Flashlights and torch cases—		
Total	36	− 29
From Hong Kong	14	− 24
,, United States	3	+ 2
,, Japan	19	− 7
Radio sets and parts—		
Total	943	+257
From Germany	25	− 18
,, United Kingdom	24	− 75
,, Japan	176	+ 33
,, Holland	17	− 6
,, United States	668	+291
Other telegraph and telephone instruments and materials—		
Total	692	−174
From Belgium	106	−181
,, Germany	162	+ 22
,, United Kingdom	17	− 11
,, United States	73	+ 45
,, Japan	207	+ 36
Electric bulbs—		
Total	459	+ 97
From Germany	16	+ 5
,, Japan	406	+ 90
,, United States	19	+ 1
Accumulators and cells—		
Total	669	+119
From Germany	40	+ 12
,, United Kingdom	11	+ 1
,, Hong Kong	193	+ 63
,, Japan	135	− 56
,, United States	270	+200
Electric meters and parts—		
Total	471	− 69
From Germany	53	− 9
,, United Kingdom	52	− 26
,, United States	78	− 20
,, Japan	238	+ 41
Electrical appliances, unspecified—		
Total	447	+182
From Germany	12	− 4
,, United Kingdom	19	− 1
,, Japan	190	+103
,, United States	183	+ 53
Electric cables—		
Total	749	− 8
From Germany	6	− 81
,, United Kingdom	373	+147
,, Japan	277	− 12
,, Belgium	28	− 54
Insulated wire and flex—		
Total	1,842	+215
From Germany	60	−187
,, United Kingdom	367	+223
,, Japan	843	+258
,, United States	345	+244
Other electrical fittings and materials, unspecified—		
Total	1,441	+297
From Germany	34	− 37
,, United Kingdom	117	+ 3
,, Japan	812	+ 63
,, United States	332	+214

Canteens in Industry

THE Industrial Welfare Society has just published a fourth revised edition of its booklet "Canteens in Industry," price 1s. 6d., post free, obtainable from the Secretary, 14, Hobart Place, London, S.W.1. Illustrations have been added to this edition and many emendations have been made in the light of experience in the organisation of war-time services.

Auxiliary Commutating Windings

A Substitute for Interpoles

INTERPOLES for the control of flux in the commutating zone cannot be used with certain classes of polyphase commutator machines such as the Schrage variable-speed motor, controlled by moveable brush-gear, and the stator-fed motor, generally controlled by a separate induction regulator.

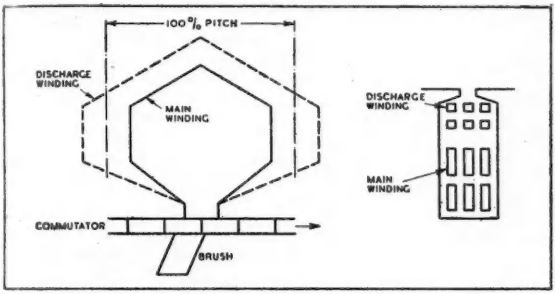


Fig. 1.—Robinson simplex damping winding

Results of the same order are, however, obtainable by the use of a damping winding which, in addition to partly neutralising the reactance voltage, compensates for the high-frequency pulsations. The damping winding consists of a discharge circuit in parallel with each rotor coil through which current continues to flow after the brush has ceased to short-circuit the commutator segments, thus reducing the rate of change of flux linking the coil.

In the Robinson simplex winding (fig. 1), consisting of two double-layer lap windings connected to the same commutator lug, the main coils are under-pitched and the discharge coils are over-pitched by an equivalent amount. The two coils lie in different slots and the total voltage round the combined circuit is zero. The smaller-section damping coil has a higher resistance and, being wound at the top of the slot, a lower inductance than the main coil.

In a modification of this scheme, devised by the British Thomson-Houston Co., Ltd. (fig. 2), the main coil is of full pitch and is connected to segments two apart so as to permit a larger flux per pole to be used without exceeding the permissible voltage between adjacent segments. A second set of main coils is connected to the intermediate segments, thus forming a duplex winding. The discharge coil has a pitch of 33⅓ per cent. and is so situated that the voltage induced by the main flux in two turns equals the voltage in one main coil ; this winding is connected to every segment so that it also equalises the potential between the two circuits of the main winding.

Both these damping windings are of the direct type. In an indirect arrangement due to Dr. B. Schwarz (fig. 3), the auxiliary winding is embedded at the bottom of the slot below the main winding and is separated from it by

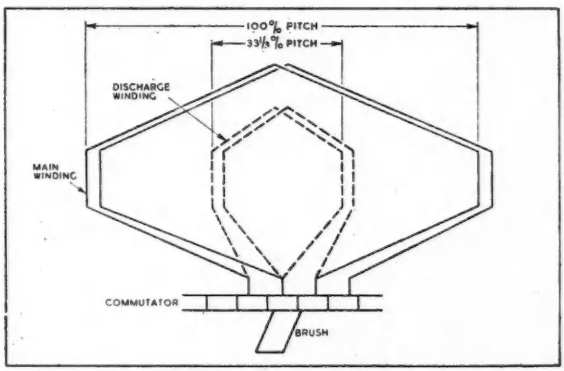


Fig. 2.—B.T.H. duplex damping winding

steel shims, which complete local magnetic circuits round the auxiliary winding conductors. The main coil is of full pitch, while the auxiliary coil in parallel consists of two turns each of 33⅓ per cent. pitch, so that the resultant voltage induced by the main flux has the same magnitude in two auxiliary turns as in one main coil.

Every main coil, *e.g.*, X in the diagram, is connected through two auxiliary coils *x* and *y*, lying in the same slot as one another to another main coil, Y, so that the action is indirect. Thus Y constitutes the discharge circuit for X acting through the transformer formed by *x* and *y*. A further advantage is that the discharge coil, in which a change of current is brought about during commutation of the preceding coil, is the next main coil to be commutated.

As a result of tests over several years with the three classes of winding, the two direct types have been found by the B.T.H. Co. to give better results, since the exact balance of voltages enables a value of resistance to be chosen that gives the most effective damping. In the embedded type, the effective discharge resistance is the sum of the resistances of a main coil and of the primary and secondary of the transformer, each consisting of two turns of the auxiliary winding. Also, some asymmetry is caused by the phase difference of voltages between the two main coils in the two slots, while those of the two auxiliary coils being the same cannot balance the main-coil voltage in both cases. Limitation of losses due to circulating currents calls for a relatively high resistance in the auxiliary windings.

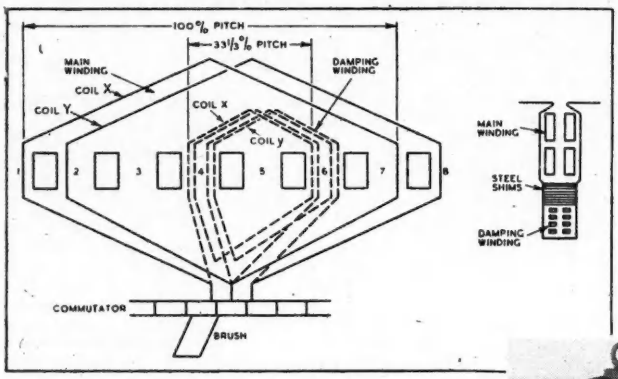


Fig. 3.—Embedded type of damping winding

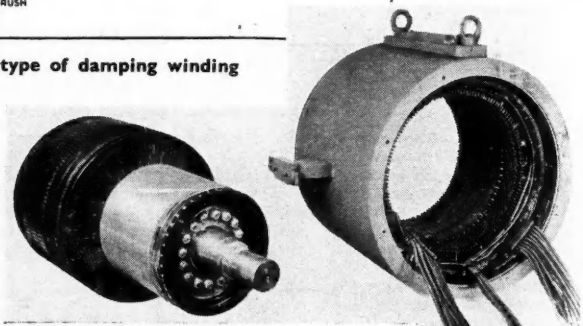


Fig. 4.—Stator-fed motor (130/40 HP, 1,600/1,000 RPM, 3,300 V) with embedded auxiliary winding

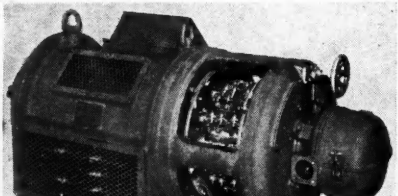


Fig. 5.—Schrage motor with duplex winding (50/0 HP, 3,000/0 RPM)

Tests on 300/100-HP, 1,120/32-RPM, 400-V Schrage motors with duplex windings showed that better commutation was obtainable with the discharge winding at the top of the slot, expecially at highest and lowest speeds, and that the rotor was more easily wound and made a better mechanical job. A 130/40-HP, 1,600/1,000-RPM, 3,300-V stator-fed motor, fitted with an embedded damping winding (fig. 4), gave commutation equal to that of Schrage motors fitted with simplex windings without discharge windings, but not so good

as that obtained with discharge windings; such an output would have been difficult to secure from a stator-fed machine without a damping winding.

Robinson simplex damping windings will, no doubt, continue to be used for smaller motors and to give increased output from existing designs for heavy duties. On the larger motors they give better performance and better mechanical construction than the earlier resistance connectors, the chief function of which was to reduce parasitic circulating currents under the brushes rather than to influence commutation of the main current. The new duplex discharge winding, as fitted in the motor shown in fig. 5, has been developed to provide, with a construction as simple as that of a simplex winding, complete equalisation of the two sections of the winding in addition to the discharge action, which is claimed to give better commutation at 100 per cent. overload than similar machines without the auxiliary winding running at full load or less. In one order for nine motors, rated at 71/4 HP (1,700/100 RPM) for crane drives, in which a low moment of inertia was necessary, the use of the duplex winding reduced the stored energy of the rotor to half of what it would otherwise have been.

For motors of standard industrial ratings, good commutation is inherently easier to obtain with a Schrage motor (in which the commutator deals with only the slip energy) than with a stator-fed machine. The B.T.H. Co. considers the former to be the better for general service, but where the supply voltage is 3,000 or higher, or a separate regulator is needed, or where a large horsepower is required at a certain speed, a stator-fed machine is recommended.

The Worthing Award

An Important Test Case

IN our issue of July 18th we made brief reference to the award of the Industrial Court in the matter of the salaries to be paid to the staff of the Worthing Corporation Electricity Department. The July *Electrical Power Engineer* publishes the award in full and holds that it establishes that the National Joint Board Schedule and conditions are "recognised terms and conditions" within the meaning of Article 5 (1) of the Conditions of Employment and National Arbitration Order, 1940.

The claim that the Worthing Corporation should give effect to the cost-of-living clause (39) in the N.J.B. Schedule was made by the Electrical Power Engineers' Association. It was stated that the Corporation had applied and operated the Schedule from 1938, when it became a member of the No. 11 District Joint Board, until January 1st this year, when it declined to grant increases in salary from that date and from July 1st. It was also contended that the claim was fair and reasonable having regard to the rise in the cost of living.

In opposition to the claim the Worthing Corporation said that it had been adversely affected by the war. Net annual losses had been incurred on the electricity undertaking; charges had been increased and any further increases would occasion hardship. It was maintained, too, that the cost-of-living index did not take into account the reduction in expenditure resulting from the rationing of commodities.

As regarded Article 5 (1) of the Conditions of Employment Order, it was contended that the National Joint Board was not a "machinery of negotiation" in that there was no organisation of employers in the industry. It was submitted that advances to the Corporation's administrative, technical and clerical staff should be the basis of settlement of the present claim.

The Court found that the N.J.B. Schedule was the "recognised terms and conditions" of employment in the electricity supply industry and awarded that the provisions of Clause 39 should be made operative to members of the technical staff of the Worthing undertaking as from January 1st.

Mining in India

HOW machine mining is growing in India is referred to in the *Indian and Eastern Engineer*, which points out that coal mines in which electricity was used numbered 144 in 1939, compared with 136 and 124 in the two preceding years. The number of coal-cutting machines was 203, compared with 186 and 140; all were operated electrically and they were installed in 72 mines. The HP utilised at coal mines aggregated 104,000 in 1939, an increase of 5,923 HP or 6.05 per cent. in twelve months, during which electrical plant was installed in seven mines. Of those already electrically equipped, one was reopened. Three serious and two fatal accidents were attributed to electricity; one fatality occurred below ground and the other on a surface transmission line. Electricity was employed in 22 metalliferous mines, in which the HP aggregated 8,107, an increase of 356.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *can be obtained from the Patent Office,* 25, *Southampton Buildings, London, W.C.*2.

1939

27375. "Automatically reclosing electrical switchgear." Maschinenfabrik Oerlikon. October 11th, 1938. (537842.)

29610. "Enclosed electric heating plates." Calor, Soc. Anon. Pour la Fabrication des Appareils de Chauffage et des Appareils à Usages Domestiques par l'Electricité. November 25th, 1938. (537818.)

29742. "Gas-blast circuit-breaker." Akt.-Ges. Brown Boveri & Cie. November 17th, 1938. (537861.)

31148. "Process and apparatus for the electrostatic separation of particles having different electrical susceptibility." H. M. Sutton and B. R. Steele. November 30th, 1939. (537819.)

31417. "Electric cables and electric cable installations." A. C. Timmis. December 4th, 1939. (537822.)

1940

40. "Low-pressure arc electric-discharge devices having activated cathodes." General Electric Co., Ltd., and M. Pirani. January 1st, 1940. (Cognate application, 8759/40.) (537826.)

310. "Photo-sensitive alarm devices." Baird Television, Ltd., and L. C. Bentley. January 5th, 1940. (537832.)

325. "Electric contacts." Mallory Metallurgical Products, Ltd. January 5th, 1939. (537865.)

326. "Electric contacts." Mallory Metallurgical Products, Ltd. February 24th, 1939. (537866.)

370. "Dynamo electric instruments." S. Smith & Sons (Motor Accessories), Ltd., and E. C. Klepp. January 6th, 1940. (537833.)

410. "Electrical transformer apparatus." Igranic Electric Co., Ltd. January 23rd, 1939. (537922.)

540. "High-tension insulators." Whessoe Foundry & Engineering Co., Ltd., and A. Puttick. January 10th, 1940. (537834.)

551. "Lighting fittings." British Thomson-Houston Co., Ltd., R. Maxted and J. N. Hull. January 10th, 1940. (537835.)

650. "Electromagnetic oscillating devices for wireless transmission." Akt.-Ges. Brown Boveri & Cie. January 25th, 1939. (537836.)

1417. "Power factor control devices involving mercury switches." W. Stern. January 24th, 1940. (537874.)

1793. "Electric junctions." Chance Bros & Co., Ltd., and A. Goetzl. January 29th, 1940. (537875.)

1878. "Measuring or indicating apparatus for measuring or indicating the angle of rotation of a rotatable spindle for use in, for example, radio receivers." Marconi's Wireless Telegraph Co., Ltd., and T. B. Hyde. January 30th, 1940. (537926.)

2518. "Lighting fittings." A. E. Iliffe and Benjamin Electric, Ltd. February 9th, 1940. (537898.)

2880. "Means for amplifying electric currents by direct-current saturated inductances." Allmänna Svenska Elektriska Aktiebolaget. February 13th, 1939. (537929.)

2881. "Means for obtaining a satisfactory curve shape of the current in direct-current saturated inductances." Allmänna Svenska Elektriska Aktiebolaget. February 13th, 1939. (537930.)

2952. "Means for locking electric lamps to lampholders." D. H. Robbins. February 16th, 1940. (537877.)

3138. "Television synchronising signal separators." Hazeltine Corporation. March 16th, 1939. (537878.)

3310. "Electric sockets." G. Subkis. February 21st, 1940. (537879.)

3391. "Means for suspending the overhead wires of electric traction systems." British Insulated Cables, Ltd., London Passenger Transport Board, J. Holland and T. C. Broom. February 23rd, 1940. (537899.)

3512. "Amplifying circuits comprising a secondary emission discharge tube." Philips Lamps, Ltd. February 27th, 1939. (537900.)

3825. "Electrical measuring instruments." Sangamo Weston, Ltd. October 30th, 1939. (537885.)

3875. "Electric-discharge lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. March 1st, 1940. (537901.)

4271. "Supports for electric lamps." British Thomson-Houston Co., Ltd. March 7th, 1939. (537886.)

4630. "Grilling apparatus." Jackson Electric Stove Co., Ltd., and W. P. Stares. March 12th, 1940. (537887.)

4811. "Electric-discharge lamps." Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington. March 14th, 1940. (537936.)

5273. "Device comprising one or more blocking layer electrode systems." Philips Lamps, Ltd. March 25th, 1939. (537889.)

5408. "Electric fuses of the cartridge type." British Insulated Cables, Ltd., and H. H. Lord. March 26th, 1940. (537902.)

5611. "Control of synchronous electric motors." British Thomson-Houston Co., Ltd. March 30th, 1939. (537839.)

6078. "Control of automatic voltage regulators." Ferranti, Ltd., and E. D. T. Norris. April 4th, 1940. (537850.)

6350. "Electrical thermal converter arrangements." Weston Electrical Instrument Corporation. April 8th, 1939. (537938.)

6873. "Insulated electrical conductors." Rockbestos Products Corporation. May 3rd, 1939. (537905.)

7102. "Automatic gain control arrangements for electric wave signalling systems." Standard Telephones & Cables, Ltd. June 21st, 1939. (537893.)

7628. "Coin inlet mechanism for prepayment apparatus." Landis & Gyr Soc. Anon. February 29th, 1940. (537939.)

(*Continued on next page*)

COMMERCE and INDUSTRY

Weald Company's Trespass. Control of Machinery.

Farmer Awarded Damages

AT Maidstone County Court recently the Weald Electricity Supply Co., Ltd., were the defendants in an action brought by Mr. Edward Brown, a farmer, of Brooklands, Staplehurst. Plaintiff claimed damages for defendants' trespassing upon his land and cutting down five trees. It was alleged that the value of the land had been depreciated by about £50 by the gap created in a spinney through the trees being cut down.

For the defence it was contended that what defendants did they had a perfect right to do under the provisions of the Electricity (Supply) Acts. In reply to a question by Judge Clements, Mr. A. R. Russell, district mains engineer, said it was possible to lop the trees, but it would not have made such a good clearance. He added that they wanted to clear the overhead line to make it safe for public supply; they made a semi-permanent job of it. His Honour held that defendants did more than they had a right to do under the Act, and became trespassers. He assessed damages at £25 with costs.

Australian Customs Decisions

The Australian Department of Trade and Customs has decided to admit free of duty insulating boards and paper (other than mica paper) for use in electrical apparatus and appliances, provided that the importer is a manufacturer of or trader in such apparatus and gives a written undertaking that the material will be used only in electrical apparatus.

Wire filaments, electrodes (leads in) and supports for use in the manufacture of electric lamps are also to be admitted free of duty.

Brush Blood Donors

The accompanying picture shows blood transfusions being effected in the first aid clinic of the Brush Electrical Engineering Co, Ltd., Loughborough, where so far 350 employees have each offered one pint of blood. The Ministry of Health medical staff from Nottingham are in attendance.

Employees of the Brush Company giving blood for transfusion

A Unique Document

Mr. K. Scott Adie, director of Rowlands Electrical Accessories, Ltd., has sent us a replica of a unique document autographed by Mr. Winston Churchill and also by Dr. Benes, Prime Minister of Czecho-Slovakia. On it are three famous quotations, two from the Prime Minister and one from Oliver Cromwell. A limited quantity of these replicas has been prepared.

Machinery and Plant Control

Further amendments have been made in the Machinery and Plant (Control) Order, 1940, by the Machinery, Plant and Appliances (Control) (No. 4) Order, 1941. The control is removed from machinery and plant when supplied to a public utility undertaking and "such supply can be made only with the licence or under the authority of a Government Department given otherwise than under this Order." Electromedical apparatus is also excepted when supplied to or for a patient, hospital or registered nursing home upon the surrender of a certificate of a registered

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New Patents (*Concluded from previous page*)

7673. "Multi-contact electric switches." British Thomson-Houston Co., Ltd. April 29th, 1939. (537940.)

8081. "Heat exchange apparatus." British Thomson-Houston Co., Ltd. May 4th, 1939. (537907.)

9813. "Signalling systems." Electrical Research Products, Inc. July 15th, 1939. (537944.)

10436. "Elastic support of transformer and like coils." Akt.-Ges. Brown, Boveri & Cie. June 22nd, 1939. (537945.)

13657. "Glasses containing lead." General Electric Co., Ltd., A. L. Marden and J. H. Partridge. August 30th, 1940. (537855.)

14730. "Thermocouples." British Driver-Harris Co., Ltd. (Driver-Harris Co.). September 30th, 1940. (537950.)

medical practitioner to the effect that the supply is necessary on medical grounds.

The machinery and plant described in the schedule to the principal Order is now "deemed to include any prime mover, electric generator (including control equipment) not exceeding 25kW, or electric motor exceeding 5 HP but not exceeding 50 HP (including control equipment), designed or appropriated for use in conjunction with any such machinery or plant."

Among the classes added to the schedule to the Order, specifying machinery and plant which may not be bought or sold without licence unless they come within the list of exceptions, are braiding machinery and plant (Class 51); electromedical apparatus (Class 54); industrial vacuum cleaning machinery and plant (Class 58); steam generating machinery and plant (not including that used exclusively for heating buildings) (Class 61); and the following electrical equipment (Class 53): Generators (including control equipment) of more than 25 kW; heavy and medium switchgear (rated at 500 A at 660 V or more); motors (including control equipment) of more than 50 HP; rectifiers, rotary convertors, rotary transformers and static condensers for p.f. correction of more than 40 kW; and transformers (other than rotary) of more than 40 kVA.

New Zealand Import Duties

The New Zealand Customs Department has decided to permit the importation free of duty of amplifying valves of approved patterns for hearing-aid instruments. Strain insulators, imported in sets of two or more with metal fittings, capable of withstanding a dry flashover test of 75 kV or more, are to be admitted free under the British preferential tariff. The duty under the general tariff is 25 per cent. *ad valorem*.

Scottish Apprentices' Wages

Three awards have recently been made by the National Arbitration Tribunal in connection with the wages of apprentices employed by Scottish electrical contractors. The firms concerned are Allan Arthur & Ure, Robert M. Russell, Ltd., and W. Muir Goodfellow & Co., Ltd.—all members of the E.C.A. of Scotland. On the apprentices' behalf the Electrical Trades Union claimed weekly wages ranging from 19s. in the first year to 47s. in the fifth year, with variations of from 2d. to 6d. per week for each 1s. fluctuation in the wages of journeyman electricians.

The Court decided that the rates per week of 47 hours should be as follows: First year, 15s.; second year, 20s. 6d.; third year, 26s.; fourth year, 32s.; and fifth year, 40s. No award was made in respect of variations in the rates.

Mobile Generating Sets

Referring to Mr. W. A. Tookey's article on "Mobile Generating Sets" in our July 18th issue, the P.R. Engineering Co. draws our attention to a service which it has just inaugurated, making available a number of mobile generating units for hire. Under the facilities offered units of from 10 to 160 kW, either DC or AC, will be available for immediate service, the time taken for securing emergency supplies of electricity by this system being in the neighbourhood of 24 hours, instead of from three to four weeks at least, under normal methods. The smaller sets supplied will be of the trailer type, while the larger will be self propelling.

Apart from obviating the necessity for stand-by plant, the importance of facilities to avoid stoppages in factories or for other essential services cannot be over-estimated. To derive the best advantage from the scheme for all interested parties the period of hire can be agreed upon by the company only as long as an emergency exists. The service will be in full operation within a month or so and the company will give special consideration to the requirements of electricity supply authorities and Government Departments.

Control of Factories and Storage in Ulster

To co-ordinate the requirements of all Government departments for factory and storage accommodation and to ensure that these requirements are met with a minimum of disturbance to other essential production, the Ministry of Commerce for Northern Ireland has made an Order whereby it is necessary for a licence to be obtained from the Ministry before any premises not hitherto used as a factory or warehouse may be so used, and before any factory or warehouse may be used for any trade or business not hitherto carried on there. This Order applies only to premises with a floor space of 2,000 sq. ft. or more, and does not affect retail shops. A general licence has been issued allowing the temporary use of premises for storage purposes for a period not exceeding twenty-eight days.

Patent Restoration

An Order was made on July 24th restoring patent No. 491390, dated January 27th, 1936, and granted to Metals & Controls Corporation, for an invention entitled "Thermostatic Electric Controls."

Fatality

A painter, Patrick McSweeney (aged 41), was working near an electric switch at Pigeon House Fort, Dublin, on July 22nd, when he received fatal burns and shock resulting from contact with the switch.

The chief engineer, Mr. T. P. O'Connor, giving evidence at the inquest, said that the gear, which had been installed in 1936, was one of the main switches for Dublin.

The jury added a rider to their verdict expressing the opinion that there was not sufficient protection in the three railings of the barrier surrounding the switch.

Lamp-caps, Lampholders and Lampholder-Plugs

The specification for "The Dimensions of Bayonet Lamp-caps, Lampholders and Lampholder-plugs for voltages not exceeding 250 volts" is a revision of B.S.S. No. 52-1936, the major change being the introduction of sections dealing with B.223-slot lampholders and with the small B15 lampholder made of moulded insulating material. Reference to the protective shield has been included and the dimensions of lampholder-plugs (b.c. adaptors) have been given in a separate section.

A few minor modifications have also been made to some of the dimensions of lampholders given in B.S.52-1936 with the object of bringing the specification more completely in line with inter-

national agreements arrived at by the International Electrotechnical Commission.

Copies of this revised B.S.S. No. 52-1941, may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. (2s. 3d. post free).

Control of Industry

A number of M.P.s, including Sir Arnold Gridley and Sir Herbert Williams have tabled a motion asking for the annulment of Defence Regulation 78 which enables a controller of an industrial establishment appointed by the Government to remove persons in managerial positions who appear to be obstructing the controller in the performance of his duties; and empowers the Government to transfer the shares of a company to nominees.

Reducing Retail Businesses

The Committee set up by the Board of Trade to advise upon problems now being faced by retail traders has sent a questionnaire to trade associations to ascertain whether it is possible to effect voluntary agreement between traders for the reduction of their numbers. The Government has stated that it cannot compensate private traders who have had to give up their businesses and so it is suggested that any voluntary scheme should include provision for compensation to those who withdraw from retail trade.

Trading with the Enemy

The Board of Trade announces that, for the convenience of traders and others, the list of specified persons, which is at present embodied in five Orders, has been published in a new Consolidating Order, just made by the Board of Trade entitled the Trading with the Enemy (Specified Persons) (Amendment) (No. 11) Order, 1941 (S.R. & O., 1941, No. 1021). Apart from the omission of persons in Greece, which is now regarded as enemy occupied territory for the purpose of the Trading with the Enemy Act and of the blockade, no deletions have been made from the present list, and there are no additions. Further amending Orders will be published shortly, containing additional names. Copies of the Order can be obtained from H.M. Stationery Office, price 2s.

Trade with Italian East Africa

As the whole of the territories formerly known as Italian East Africa are now in British hands, the Board of Trade has issued an order (S.R. & O. 1941, No. 1116) authorising persons, so far as the Trading with the Enemy Act is concerned, to trade with any body of persons (whether corporate or unincorporate) carrying on business in these territories. This licence does not, of course, absolve persons from complying with other regulations in force in the United Kingdom and in the said territories. Inquiries from traders may be addressed, through their agents, direct to the Deputy Chief Political Officer in the territory concerned.

Heat-treatment of Aluminium

The latest bulletin of the Research and Development Department of the Northern Aluminium Co., Ltd., is devoted to a comprehensive survey of the technique of heat-treatment of aluminium and its alloys. After summarising important aspects of the theory and practice of solution and precipitation heat-treatment and annealing, particularly as applied to the higher strength alloys, recommendations are made as to means for ensuring successful results.

Modern equipment is described, including the recently introduced use of refrigeration (cold-treatment) storage plant for delaying the age-hardening of certain types of alloys, which promotes economy in press operation. The potentialities of this development in removing bottlenecks in aircraft production are already widely appreciated. Diagnosis of complaints and maintenance of furnaces and pyrometric equipment are also dealt with, while data is given for heat-treatment processes.

Electrically heated baths possess the advantage that they do not yield products of combustion, which must not come into contact with the metal, since molten nitrate in association with carbonaceous substances constitutes a severe fire hazard. Furnaces in which air heated by electric resistance elements is forced by fans to circulate through the load at high speed are being increasingly used. Copies of this bulletin may be obtained from the company.

Dissolution of Partnership

Messrs. E. H. Leaf, W. M. Carver and J. G. Barber, trading as Leaf & Barber, electrical engineers, 47, Victoria Street, London, S.W.1, have dissolved partnership so far as concerns Mr. W. M. Carver. All debts will be attended to by Messrs. E. H. Leaf & J. G. Barber, who will carry on the business under the same name.

Trade Announcement

The Bective Electrical Co., Ltd., has opened a Midlands branch office at 27, Belvoir Street, Leicester, which will deal with its contracts in that area. Mr. W. F. Parker, A.M.I.E.E., who has been the company's deputy chief engineer for the past three years, has been appointed manager.

New Catalogues and Lists

Sloan Electrical Co., Ltd., 41, Kingsway, London, W.C.2.—Price revision booklet No. 4, which gives up-to-date prices of all lines listed in the company's general catalogue.

Simplex Electric Co., Ltd., Broadwell Road, Oldbury, Birmingham.—List P.R.10 giving the current prices of the company's products, with notes on the application of the Purchase Tax.

TRADE MARK APPLICATIONS

AMONG recent applications for British trade marks are the following, objections to which may be entered within a month of July 30th:—

REDISEM. No. 613243, Class 9. Electric teleprinters, electric convertors, remote control equipment for electrical communication systems, switchboards, switches and electric regulators, Rediffusion, Ltd., Bush House, Aldwych, London. W.C.2.

THE AIRSCREW CO., LTD. (design). No. 615207, Class 11. Ventilating fans and ventilating, heating, drying, refrigerating apparatus, all incorporating fans. The Airscrew Co., Ltd., Grosvenor Gardens House, Westminster, London, S.W.1.

ELECTRICITY SUPPLY

London J.E.A. Finance.

Alderley Edge and Wilmslow.—CHEAPER ELECTRICITY.—At the last meeting of the Alderley Edge and Wilmslow Electricity Board (engineer and manager, Mr. C. Cameron Kirby) it was decided to reduce all published tariffs by 5 per cent. commencing with the September quarterly accounts. The charges for the hire of apparatus and meter rents are remaining at the pre-war figures.

Bath.—RATE CONTRIBUTION.—It is reported that the Electricity Department is to contribute £7,500 to the rates as the result of its operations for the past year.

Cheltenham.—TRANSFORMERS & SWITCHGEAR.—The Corporation Electricity Committee has obtained sanction to take £3,324 from its surplus in connection with the provision of four 500-kVA transformers and switchgear, and the Electricity Commissioners intimate that if it is found that sufficient surplus is not available, they will issue loan sanction.

Chesterfield.—SUPPLY IMPROVEMENT.—The Corporation Electricity Committee is to improve the supply in the Whittington Moor area at a cost of £341.

Sanction has been obtained by the Committee to borrow £1,500 for mains and services and £500 for meters.

Ealing.—SUPPLY ARRANGEMENTS.—The Corporation Electric Supply Committee is seeking sanction to spend £6,950 on an 11-kV supply point, and £1,050 on a three-phase low-voltage supply point for a distributing station.

Eccles.—LOANS FOR EQUIPMENT.—The Corporation Electricity Committee is seeking sanction to borrow £2,000 for substation equipment, £1,000 for domestic appliances and £1,500 for mains and services.

FRINGE ORDER.—The Corporation Electricity Committee is seeking a Fringe Order to supply premises.

Great Yarmouth.—PRICE INCREASE DISAPPROVED.—After the borough electrical engineer (Mr. P. Rycroft) had conferred with the Electricity Commissioners on the subject, the Corporation Electricity Committee recommended that electricity charges should be increased by 15 per cent. The General Purposes Committee, however, opposed this proposal and furthermore recommended that the 10 per cent. addition to hire charges of apparatus which had been in force since last October should be discontinued. Councillor W. G. Knight, chairman of the Electricity Committee, pointed out that the Council was selling electricity at considerably below cost price. If the recommendation were not approved they would face a loss of £40,000 next year. Councillor W. J. Page opposed the increase because the people who would have to bear it were those who must remain in Yarmouth because their presence was essential. Councillor J. W. Beckett said the proposal was inconsistent with the Council's application to the Ministry of Health to restrict public utility undertakings not under the Council's control from increasing their charges because the population of the town could not pay. Asked for his observations, Mr. Rycroft said that while it was true that the population of the town had decreased, about 40 per cent. of the undertaking's revenue came from the rural areas which obtained a supply on very favourable terms, and in these areas the population had increased. The amendment was carried and Councillor Knight thereupon proposed that the whole matter should be further considered by the Electricity Committee, but this was not agreed to.

South Shields & C.E.B.

Ilford.—SUBSTATION.—The Corporation Electricity Committee is to provide a substation in High Road, Seven Kings, at a cost of £1,575.

London.—BATTERSEA.—Electric heating is to be installed at the Thessaly Road shelters at a cost of £65 and lighting at the Clapham Common shelters is to be improved at a cost of £350.

LEWISHAM.—The Emergency Committee is to install electricity at the Home Park depot at a cost of £140.

ST. MARYLEBONE.—In connection with repair works to the DC network bounded by Edgware Road, George Street, Portman Square and Seymour Street, the Borough Council Electricity Committee has approved a scheme of the borough electrical engineer for utilising existing AC distributors and changing certain installations over to AC instead of restoring the DC system to a reasonably safe condition.

J.E.A.'s BORROWING POWERS.—The Finance Committee of the London & Home Counties Joint Electricity Authority reported at yesterday's meeting of the Authority that it had received a report upon the Authority's borrowing powers (limited by the 1925 Order to £7,000,000) and the extent to which they had been exercised. The Committee has given instructions for the Electricity Commissioners to be approached with a view to the promulgation of an Order increasing the borrowing powers.

Manchester.—SUBSTATIONS.—The Town Council has obtained sanction to a loan of £10,000 for substations and equipment.

ELECTRICAL APPARATUS FOR SHELTERS.—The Corporation Emergency Committee has authorised the provision of electric boiling plates and water boilers in the larger public shelters.

Mansfield.—REDUCED CHARGES.—It was reported to the Town Council last week that the Electricity Committee had decided to discontinue the 5 per cent. war increase in charges as from the June quarter meter readings.

Monmouth.—PROTEST AGAINST INCREASE.—Under the deed transferring the electricity undertaking from the Corporation to the Monmouth Electricity Co., Ltd., the price charged for electricity for lighting must not be more than 6½d. per kWh. The company has, however, applied to the Electricity Commissioners for an Order relaxing this limitation of price so that the company may charge a rate not exceeding 7½d. per kWh. At a special meeting of the Town Council recently it was unanimously decided to make representations to the Commissioners against the proposed increase.

Nottinghamshire. — SHELTER LIGHTING. — The County Education Committee is to install electric lighting in school shelters in nine areas at a cost of £4,372.

South Shields.—NEGOTIATIONS WITH C.E.B.—The Town Council has received a request from the Central Electricity Board for compensation for loss of revenue suffered by the Board as a result of the Corporation taking a bulk supply of electricity for part of the area from the North-Eastern Electric Supply Co., Ltd., instead of from the Board. The Town Clerk reported that the Board had agreed to the Corporation taking a bulk supply from the company for the purpose until a new 11-kV cable had been laid ; there was now little possibility of this being done until after the war. The Board had suggested that the Corporation should continue to take its bulk supply from the company, and pay the Board £700 per annum, beginning on January 1st this year.

Sutton Coldfield.—EXTENSIONS PROPOSED.—In 1939 a scheme was under consideration for supplementing the extra-high-voltage supply to the Streetley area, but the matter was postponed for the time being. The Corporation Electricity Committee now reports that during the past two winters the peak loads in the area were only carried with difficulty. Arrangements have been made with the Birmingham Corporation for it to supply and lay at its expense a feeder, subject to an assurance that notice to terminate the existing bulk supply agreement will not be made before September, 1946. The Electricity Committee proposes to continue the feeder to the transformer kiosk at Hill Farm, Streetley, at an estimated cost of £1,700. This arrangement will ensure a satisfactory supply to the Streetley district for several years provided that no abnormal development takes place.

Watford.—RESTRICTION OF HIRE SCHEME.—In view of the difficulty of obtaining sufficient stocks of immersion heaters and carrying out maintenance work, the Corporation Electricity Committee has temporarily withdrawn facilities for the hire and hire-purchase of equipment of this type.

SUPPLY TO BOVINGTON.—The Corporation Electricity Committee has arranged terms for supplying premises at Bovington which will entail extension of the high-voltage distribution system and the provision of a substation. Terms have also been agreed upon for a factory supply involving the provision of a substation.

Overseas

Brazil.—ELECTRICAL PROGRESS.—The Brazilian Traction, Light & Power Co., Ltd., which through its affiliated concerns controls the electricity supply in the cities of Rio de Janeiro, San Paulo and Santos, states in its report for 1940 that the sales of the three undertakings amounted during the year to 1,658.2 million kWh, compared with 1,555.2 million kWh in 1939, an increase of 6.6 per cent. Additions to generating plant during the year brought the total capacity to 554,234 kW. New consumers numbered 29,865, making altogether 561,868. In Rio de Janeiro and San Paulo nearly 1,700 additional electric street lamps were put into service.

The report states that the construction of the Serra do Cubatas hydro-electric plant near San Paulo was continued. In connection with the modernisation of the Lages generating station, the first 48,000 HP unit was put into operation during the year; another similar unit has been delivered in part, but considerable delay is being experienced in obtaining the remainder.

Canada.—RECORD OUTPUT.—Production at central electric stations reached the record total of 2,805 million kWh in May, the Dominion Bureau of Statistics reports. This represents a 5 per cent. increase over May, 1940. The aggregate output for the first five months of this year was 13,172 million kWh against 12,390 million kWh in the corresponding period of 1940. Exports to the United States in the first five months of 1940 were 993 million kWh compared with 808 million kWh in the same period of last year.

LOWER LIGHTING CHARGES.—A reduction of approximately 10 per cent. in commercial lighting rates will take effect in Toronto shortly. Revenue from this class of consumer has recently been substantially in excess of the cost.

Tasmania.—DEVELOPMENT AT LAUNCESTON.—For the Launceston Council's electricity undertaking the whole of the supply is obtained from hydro-electric sources, a small part being generated by the city's plant at Duck Reach and the remainder purchased from the Hydro-electric Commission, whose principal stations are at Waddamana and Tarraleah. Mr. R. J. Strike, city electrical engineer, reports that during the year to June 30th, 1940, the total supply generated and purchased was 29.0 million kWh (23.5 million from the Hydro-electric Commission), an increase of 4.0 million kWh over the previous year.

Excluding consumption for street lighting and tramways, 22.4 million kWh was sold, which on an estimated population of 33,200 works out at 676 kWh per head. Aggregate connections at June 30th, 1940, amounted to 40,175 kW; the largest increase during the year was that of 1,671 kW in the electric cooker load. Total revenue rose by £13,435 to £105,570, with an average price per kWh sold (private supply) of 1.006d., and working expenses advanced by £6,662 to £71,775. Interest, etc., charges at £12,440 were only slightly above the previous year, so that there was an appreciable improvement in the net surplus, which amounted to £21,355 against $13,784 in 1938–39.

RADIO AND TELEPHONY

Brazil.—ADOPTION OF AUTOMATIC TELEPHONY.—A feature of the 1940 report of the Brazilian Telephone Co. (subsidiary of the Brazilian Traction, Light & Power Co., Ltd.) is the progress which is being made in the adoption of automatic telephony. The last remaining manual exchange in the Federal District of Rio de Janeiro was replaced in October last by an automatic exchange. It is added that of the 224,069 telephone instruments in use in Brazil at the end of 1940, 176,611, or nearly 80 per cent., were automatic. During the year an adjustment of the telephone rates in the Federal District of Rio de Janeiro was granted, a supplementary agreement covering a period of five years being signed in September last. Under this, increased rates are provided for residential telephones and measured service for business telephones, subject to minimum and maximum charges. No settlement of the long outstanding question of an adjustment of the telephone rates in San Paulo has yet been reached.

FINANCIAL SECTION

Company News. Stock Exchange Activities

Reports and Dividends

The General Electric Co., Ltd.—Proceedings at the annual general meeting last week were purely formal. Lord Hirst, the chairman, an abstract of whose statement appeared in our July 25th issue, presided and proposed the adoption of the report and statement of accounts. This was seconded by Mr. M. Railing and carried unanimously. The chairman then proposed, and Lord Clarendon seconded, the payment of the dividend of 10 per cent., plus a cash bonus of 7½ per cent. on the ordinary stock and this was again carried unanimously. Lord Clarendon, Mr. Arthur Chamberlain, Mr. J. H. Farthing and Mr. T. W. Heather, the retiring directors, were re-elected. The meeting concluded with a vote of thanks to the chairman.

The Oriental Telephone & Electric Co., Ltd.—Presiding at the annual meeting on July 29th Sir A. Henry McMahon (chairman) said that there had been a satisfactory increase in the profits of the Singapore branch, and the Hongkong, China and Japan, and Rangoon Telephone Companies had paid their usual dividends. With regard to the Indian companies, the Government of India had made an offer to buy the shares. The offer had been accepted by the shareholders of the Bengal Telephone Co., but the requisite majority for the acceptance of the offer relating to the Madras Company had not been secured, and the Oriental Telephone Co. was considering a suggestion of the Government of India that they should sell them their shares in the company by private treaty. The poll in respect of the Bombay Telephone Co. had been concluded and the results were now being scrutinised by the Government of India.

Franco Signs, Ltd., reports that the combined trading profits of the subsidiary companies for the year to September 30th totalled £22,805, as compared with £19,011 for the preceding year. In view of the amount standing to the credit of the parent company's revenue account, it has been decided not to declare any dividends from the subsidiaries. Franco Signs is paying a dividend of 5 per cent. for the year to March 31st (same), and £11,410 is carried forward (against £16,441 brought in).

The Reason Manufacturing Co., Ltd., reports a profit for the year ended January 31st of £4,129, as compared with £3,729 for the previous year. The ordinary dividend is again 1s. per share and £3,722 is carried forward (against £3,117 brought in).

The Pernambuco Tramways & Power Co. propose the suspension of the sinking fund on the outstanding £913,975 5 per cent. first debentures for a further five years from 1942 to 1946 inclusive. In July, 1938, debenture holders agreed to suspend the sinking fund for 1939 and 1940, and to accept in payment of interest for 1938 and 1939 whatever sterling the company was able to realise from its cash balances at January 1st, 1938, and from its "available cash receipts" during the same period up to 5 per cent. per annum (after deduction of capital expenditure of up to 3,500 contos annually). Later a committee extended these arrangements for a year and increased the authorised capital expenditure for 1940 from 3,500 to 10,580 contos. The directors now point out that the company has been able to pay the debenture interest in full up to and including January 1st, 1941, but that the period covered by these arrangements has expired. They now also propose that the limit on capital expenditure should remain at 3,500 contos per annum, with the privilege to the company to ask the committee to authorise sums in excess of 3,500 contos during the period ending December 31st, 1944. The committee would also be authorised to extend the arrangements (except as to the suspension of the sinking fund) annually for two additional years.

The Costa Rica Electric Light & Traction Co. has called a meeting for August 13th of the holders of the 6 per cent. prior lien debentures to consider a proposal for the immediate consolidation of the company with the Compania Nacional de Electricidad and the Compania Nacional Hidroelectrica with whom the company has been associated for some time. This involves the formation of a new company — Compania Nacional de Fuerza y Luz—which would take over the obligations towards the holders of the 6 per cent. prior lien debentures. The directors say that this move is the outcome of the strong agitation for the nationalisation of public utilities which has existed for many years in Costa Rica.

The Palestine Electric Corporation, Ltd., reports a net profit for 1940 of £114,134, as compared with £151,435 for the preceding year. The directors have decided not to recommend a dividend on the ordinary and "A" ordinary shares for 1940. No dividend was paid for 1939.

The Madras Electric Supply Corporation, Ltd., has declared a final dividend of 2½ per cent., making 4 per cent., tax free, for the year. The final rate for 1939 was 4 per cent., making 6 per cent., tax free.

Ward & Goldstone, Ltd., are maintaining their dividend for the year at 20 per cent., by a final payment of 10 per cent.

The London Electric Supply Corporation, Ltd., is maintaining its interim dividend at 3 per cent.

The Northmet Power Co. is again paying an interim dividend of 3 per cent.

Richardsons, Westgarth & Co., Ltd., have announced a dividend for the year of 7½ per cent. (unchanged).

The Rangoon Electric Tramway & Supply Co., Ltd., is paying an interim dividend of 4 annas a share free of Burma tax (unchanged).

The City of London Electric Lighting Co., Ltd., is again paying an interim dividend of 3 per cent.

New Companies

Barking Electrical Co., Ltd.—Private company. Registered July 17th. Capital £100. Objects: To carry on the business of manufacturers and

repairers of and dealers in electrical plant, appliances and supplies, etc. Directors: E. V. A. Wiseman, Longmayes, Cranstone Park Avenue, Upminster; and E. L. M. Downes, 2, Randall Drive, Hornchurch. Registered office: Station Chambers, East Street, Barking, Essex.

Mutual Radio Service, Ltd.—Private company. Registered July 19th. Capital £500. Objects: To carry on the business of radio service engineers, repairers of radio and electrical appliances and apparatus, etc. Directors: W. E. S. Champion, 60, Gassiott Way, Sutton, Surrey, and four others. Registered office: 97, High Street, Wimbledon, S.W.19.

Warfield Moulders, Ltd.—Private company. Registered July 22nd. Capital £1,000. Objects: To carry on the business of manufacturers of and dealers in bakelite plastic mouldings, compounds and synthetic products, makers of tools, instruments and electrical and wireless components, accessories and fittings, engineers, etc. Subscribers: G. R. Howden, 23h, Peabody Estate, Wild Street, W.C.2, and G. R. Starr, 32, Church Crescent, S. Hackney, E.9. Registered office: Bush House, Aldwych, W.C.2.

L. K. Millen & Co., Ltd.—Private company. Registered July 30th. Capital £200 in 200 shares of £1 each. Objects: To carry on the business of mechanical, electrical and general engineers, tool makers, wire drawers, etc. Directors: L. K. Millen, 198, Ealing Road, Wembley, Middlesex, and C. Sharpe, 100, Windmill Road, Brentford. Registered office: 12, Alperton Viaduct, Wembley, Middlesex.

Ace Scientific Instruments, Ltd.—Private company. Registered July 29th. Capital £500. Objects: To carry on the business of manufacturers of and dealers in scientific instruments of all descriptions, electrical, optical and mechanical devices, etc. Directors: L. C. Welch, and D. R. Welch, both of "Riverways," Esher Place Estate, Esher, Surrey. Registered office: Ace of Spades, Kingston-By-Pass, Surbiton, Surrey.

Electrical & General Accessories (Leicester) Ltd.—Private company. Registered July 25th. Capital £2,000. Objects: To acquire the business of dealers in electrical and gas fittings and general accessories carried on by Joseph Lewis at Tower Chambers, Churchgate, Leicester, as the Electrical and General Accessories Co. Directors: J. Lewis, address not stated, and three others.

Companies' Returns

Statements of Capital

Power Securities Corporation, Ltd.—Capital £2,000,000 in 1,000,000 7 per cent. cumulative participating preference and 1,000,000 ordinary shares of £1. Return dated March 6th, 1941. 500,000 preference and 800,000 ordinary shares taken up. £1,300,000 paid. Mortgages and charges: Nil.

Notting Hill Electric Lighting Co., Ltd.—Capital £450,000 in 250,000 ordinary shares of £1 and 20,000 preference shares of £10 each. Return dated March 18th, 1941. 135,250 ordinary and 20,000 preference shares taken up. £201,352 10s. paid (1s. on 27,050 ordinary and £10 on 20,000 preference shares). £133,897 10s. considered as paid (£1 on 108,200 ordinary and 19s. on 27,050 ordinary shares). Mortgages and charges: £131,850.

Croydon Cable Works, Ltd.—Capital £170,000 in £1 shares. Return dated March 26th, 1941. 700 shares taken up. £700 paid. Mortgages and charges: Nil.

Northampton Electric Light & Power Co., Ltd.—Capital £1,000,000 in £925,000 ordinary stock and £75,000 preference stock. Return dated March 27th, 1941. £52,500 preference and £870,000 ordinary stock taken up. £922,500 paid. Mortgages and charges: £600,000.

South Somerset & District Electricity Co., Ltd.—Capital £200,000 in £1 shares. Return dated April 2nd, 1941. All shares taken up. £206,531 5s. paid (including a premium of 2s. 4½d. per share on 55,000 shares). Mortgages and charges: Nil.

Boothroyd Electrical Co., Ltd.—Capital £2,000 in 2,000 shares of £1 each. Return dated January 1st, 1941. 1,773 shares taken up. £1,773 paid Mortgages and charges: £1,000.

Lancashire United Transport & Power Co., Ltd.—Capital £600,000 in 300,000 preference and 300,000 ordinary shares of £1. Return dated March 14th, 1941. 300,000 preference and 276,208 ordinary shares taken up. £101,306 paid. £474,902 considered as paid. Mortgages and charges: £241,669. A further £50,000 stock has been deposited as security for possible advances.

Chesham Electric Light & Power Co., Ltd.—Capital £300,000 in £1 shares. Return dated March 18th, 1941. 265,000 shares taken up. £244,998 paid. £20,002 considered as paid. Mortgages and charges: Nil.

Alton District Electricity Co., Ltd.—Capital £35,000 in £1 shares. Return dated March 20th, 1941. All shares taken up. £35,000 paid. Mortgages and charges: Nil.

Loch Leven Electricity Supply Co., Ltd.—Capital £10,000 in £10 shares. Return dated March 25th, 1941. 500 shares taken up. £5,000 paid. Mortgages and charges: Nil.

Mortgages and Charges

Underwood (Electric), Ltd.—Assignment of proceeds of certain contracts, dated July 17th, 1941, to secure all moneys due or to become due from the company to Martins Bank, Ltd. not exceeding £900.

Increases of Capital

London Electrical Co. (Sherborne Lane), Ltd.—The nominal capital has been increased by the addition of £2,000 in £1 ordinary shares, beyond the registered capital of £14,000.

L.P.S. Electrical Co., Ltd.—The nominal capital has been increased by the addition of £5,000 beyond the registered capital of £20,000. The additional capital is divided into 5,000 5½ per cent. redeemable preference shares of £1 each.

Liquidation

Neon Advertisements, Ltd.—Meetings pursuant to Section 245 of the Companies Act, 1929, on August 29th, at 5, Rumford Place, Liverpool, to receive an account of the winding-up by the liquidator, Mr. P. S. Booth.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets are swayed by the character of the news, and this being recently read as encouraging, a further rise in security prices has occurred. The advance is mostly in the ordinary shares of front-rank industrial companies, there having been a certain amount of exchanging from purely gilt-edged stocks into shares of which Callender's, Henley's, British Insulated and General Electrics, may be quoted as representative examples.

At the General Electric meeting, Lord Hirst showed that taxation led to the reduction in the rate of bonus usually declared by the company. The Henley report brought in buyers of the shares. Home Railway stocks are in the ascendant owing to an official statement which promised early publication of an agreement between the Government and the railway companies, and which hinted at this being in favour of the companies.

Fluctuations in Prices

The principal movement in prices this week is a fall of 5 in Tokyo Electric 6 per cent. bonds, reducing the price to 30½, at which the yield on the money—so long as the interest remains paid—is a shade under 20 per cent. The Home electricity supply market is very firm, sustained by the constant purchases of stock which are being made in it, and by the interim dividends, most of them repeating the distributions of a year ago. Scottish Power and Northmets are 9d. better at 37s. and 33s. 3d. respectively. Isle of Thanet rose to 8s. 6d. In the overseas list, Whitehall preference advanced to 13s. 9d. Jerusalem Electrics at 18s. 9d. lost the $\frac{1}{16}$ which they gained a week ago. Cable and Wireless preference hardened to 102, the ordinary stock, however, being dull at 60. In the manufacturing group, Mather & Platt, on pressing demand from the country, strengthened to two guineas. General Electric ordinary at 80s. have recovered the dividend of 1s. 9d. net. Johnson & Phillips are $\frac{1}{16}$ higher at 2½. British Aluminium improved to 45s. 9d. Amongst the armament shares, Vickers came into notice, and put on 6d. to 16s. 3d.

Electric Power Charges

Questions were raised in the House of Commons last week as to the cost of electric power. The Chancellor of the Exchequer promised to look into any particular cases that were brought to his notice. Sir Kingsley Wood added that the Commissioners had informed all electricity undertakers that no further increase in electricity charges, other than those already announced, should be made until the proposals had been submitted to the Commissioners.

The matter is one of no little importance to holders of shares in electricity supply companies, but, from the standpoint of to-day's position, it is doubtful whether the companies, on the whole, are doing less well than they did under pre-war schedules. Consequently the investor in electricity supply shares need feel no qualm or uneasiness from the statement made by the Chancellor of the Exchequer, and share prices, as already mentioned, are maintaining all their previous strength.

Tax-Free Dividends

The Palestine Electric Co. caused some surprise, and a shade of disappointment, by passing the dividend on the ordinary and the "A" ordinary shares. The company made a profit for 1940 of £114,000, which is about £37,000 less than that in the previous year, when also the dividend was passed. It had been thought, however, that in view of the more peaceable state of affairs which is now prevailing, the directors would have declared a small dividend. The price of the shares fell to 17s. 6d., but recovered to 18s. 3d. Cawnpore Electric new ordinary are on offer at 28s. 6d. free of stamp. Calcutta ordinary can be bought at 36s. to yield £3 17s. 9d. free of tax on the dividend of 7 per cent. tax free, paid for 1940, against 8 per cent. in 1939, and 10 per cent. in the two preceding years, all free of tax. Madras Electric Supply is another company which usually pays its dividends net. At 23s., the yield, on the basis of the last-paid 4 per cent. tax-free dividend, is £3 9s. 7d. free of tax.

Aron Electric Dividend

Holders of Aron Electricity Meter shares welcome the return of their company to the dividend paying list, after its lapse a year ago. The company had paid 15 per cent. per annum for the five years 1935-1939 inclusive, following two dividends of 10 per cent. in the two preceding years. The dividend now is 7½ per cent. in respect of the year to March 31st last. The announcement was not entirely unexpected, as, indeed, the previous price of the shares, 18s., clearly indicated. It is hoped that the Aron Company will work up to its previous 15 per cent. dividend, though whether any material advance will occur during the war period is open to doubt.

Oriental Telephone

In peacetime it would be cricket to say that shareholders in the Oriental Telephone Co. are on a good wicket, seeing that the prices of the shares have advanced 5s. to 65s. on the statements made at the meeting last week. The Indian Government has offered to buy

(*Continued on page* 74)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Aug. 5	Rise or Fall	Yield £ s. d.
Home Electricity Companies					
Bournemouth and Poole	15	12½	50/9	+9d.	4 18 5
British Power and Light	7	6	25/–	..	4 16 0
City of London	7½	7	23/9	..	5 18 0
Clyde Valley	8	8	35/9	..	4 9 6
County of London	10½	8	33/3	..	4 16 3
Edmundson's:					
7% Pref.	7	7	30/9	..	4 11 1
Ord.	6	6	26/6	..	4 10 7
Elec. Dis. Yorkshire	9	9	38/9xd	−6d.	4 3 0
Elec. Fin. and Securities	12½	12½	42/6	..	5 17 8
Elec. Supply Corporation	11½	10	40/–	..	5 0 0
Isle of Thanet	2	Nil	8/6	+6d.	—
Lancs Light and Power	7½	7½	32/–	..	4 13 9
Llanelly Elec.	5½	5½	20/–	..	5 10 0
Lond. Assoc. Electric	5½	4½	17/6	..	5 2 10
London Electric	7	7	23/9	..	5 18 0
London Power Deb. Red.	5	5	104	+½	4 16 2
Metropolitan	10	8	33/3xd	..	4 16 3
Midland Counties	8	8	37/–	..	4 6 5
Mid. Elec. Power	9	9	35/–	..	5 2 10
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec.:					
Ordinary	7	7	29/6	..	4 15 0
7% Pref.	7	7	33/3	..	4 4 2
Northampton	10	10	43/9	..	4 11 5
Notting Hill 6% Pref. (£10)	6	6	8½	..	—
Northmet Power:					
Ordinary	10	7	33/3	+9d.	4 4 2
6% Pref.	6	6	29/6	..	4 1 4
Richmond Elec.	6	6	22/6	..	5 6 8
Scottish Power	8	8	37/–	+9d.	4 6 5
Southern Areas	5	5	16/3	..	6 3 0
South London	7	7	23/6	..	5 19 2
West Devon	5	5	21/3	..	4 14 1
West Glos.	4½	4½	18/3	..	4 18 8
Yorkshire Elec.	8	8	38/3xd	..	4 4 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	2/6	..	—
Calcutta Elec.	8*	7*	35/6	..	3 19 0
Cawnpore Elec.	10	10	27/6xd	..	7 5 9
East African Power	7	7	25/9	..	5 8 9
Jerusalem Elec.	7	7	18/9	−⅛	7 9 4
Kalgoorlie (10/–)	7½	7½	12/6	..	6 0 0
Madras Elec.	6*	4*	23/–	−3d.	3 9 7
Montreal Power	1½	1½	24½	..	6 2 5
Palestine Elec. "A"	Nil	Nil	18/3	..	—
Perak Hydro-elec.	2½	6	17/6	..	6 17 2
Shawinigan Power	83cts.	90cts.	16	..	—
Tokyo Elec. 6%	6	6	30½	−5	19 13 4
Victoria Falls Power	15	15	77/6	..	3 17 4
Whitehall Inv. Pref.	7½	7½	13/9	+⅛	10 18 2

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Aug. 5	Rise or Fall	Yield £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	110xd	+½	4 11 1
1955–75	5	5	113	..	4 8 6
1951–73	4½	4½	107	−1	4 4 1
1963–93	3½	3½	100½	..	3 9 8
1974–94	3½	3½	94	..	3 9 2
London Elec. Trans. Ltd.	2½	2½	94	..	2 13 2
London & Home Counties 1955–75	4½	4½	106½	..	4 4 6
Lond. Pass. Trans.					
A	4½	4½	113½	..	3 19 4
B	5	5	109½	..	4 11 4
C	1½	3	36xd	..	8 6 8
West Midlands J.E.A. 1948–68	5	5	108½	..	4 12 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	105½	..	5 13 9
Def.	1½	1½	24½	..	6 2 5
Anglo-Portuguese	8	8	15/–	..	10 13 4
Cable & Wireless:					
5½% Pref.	4½	5½	102	+½	5 7 10
Ord.	4	4	60	−½	6 13 4
Canadian Marconi $1	Nil	4cts.	6/3	−3d.	3 5 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	27/6	..	—
Pref.	6	6	27/6	..	4 7 3
Great Northern Tel. (£10)	20	20	12½	..	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	25/–	..	6 3 0
Oriental Tel. Ord.	11½*	16	3½	+¼	5 2 4
Telephone Props.	6	6	11/3	..	10 13 4
Tele. Rentals (5/–)	10	10	7/3	..	6 18 0
Traction and Transport					
Anglo. Arg. Trams:					
First Pref. (£5)	Nil	Nil	2/–	..	—
4% Inc.	Nil	Nil	4½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	860	+5	5 4 8
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8*	8	41/3	..	3 17 8
Brazil Traction	$1	50c.	8½	+¼	—
Calcutta Trams	8	5½	18/–	..	6 2 3
Cape Elec. Trams	5	5	17/–	..	5 17 4
Lancs Transport	10	10	40/–	..	5 0 0
Mexican Light:					
1st Bonds	5	5	45	..	—
Rio 5% Bonds	5	5	85	..	5 17 8
Southern Rly.:					
5% Prefd.	5	5	55½xd	+2	9 1 10
5% Pref.	5	5	97½xd	+½	5 2 7
T. Tilling	10	10	45/–	..	4 9 0
Tilling & B.A.	8*	7*	52/6	..	2 13 4
West Riding	10	10	38/–	..	5 5 4

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939-40	Dividend 1940-41	Middle Price Aug. 5	Rise or Fall	Yield p.c.
Equipment and Manufacturing					
Aron Elec. Ord. ..	15	7½	18/–	..	£ s. d. 8 6 8
Assoc. Elec. :					
Ord.	10	10	42/6	..	4 14 3
Pref.	8	8	36/3	+⅛	4 8 5
Automatic Tel. & El.	12½	12½	45/–	..	5 11 1
Babcock & Wilcox	11	11	43/9	..	5 0 6
British Aluminium	12½	10	45/9	+9d.	4 7 4
British Insul. Ord.	20	20	87/6	..	4 11 4
British Thermostat (5/–)	18½	18½	12/6	..	7 8 0
British Vac. Cleaner (5/–)	40	12½	6/3	..	10 0 0
Brush Ord. ..	Nil	Nil	3/9	..	—
Callender's ..	15	15	65/–	..	4 12 4
Chloride Elec. Storage	15	15	62/6	..	4 15 10
Consolidated Signal	17	17	62/6	..	5 8 7
Crabtree (10/–) ..	17½	17½	26/3	..	6 13 4
Crompton Parkinson Ord. (5/–) ..	30	20	19/6	..	5 2 8
E. K. Cole (5/–) ..	10	Nil	7/–	..	—
E.M.I. (10/–) ..	5	Nil	12/–	..	—
Electric Construction	10½	10	32/6	..	6 3 0
Enfield Cable Ord.	16½	12½	48/9	..	5 2 6
Elecl. Switchgear (10/–)	16	10	20/–	..	5 0 0
English Electric ..	10	10	35/–	..	5 14 2
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)..	25*	22*	37/6	..	2 18 8
Ever Ready (5/–) ..	40	40	28/–	–3d.	7 2 10
Falk Stadelmann ..	6	7	17/6	..	8 0 0
Ferranti Pref. ..	7	7	26/3	..	5 6 10
G.E.C. :					
Pref.	6½	6½	32/6	..	4 0 0
Ord.	20	17½	80/–xd	+1/9	4 7 6
Greenwood & Batley	15	13	22/6xd	+1/–	11 11 2
Hall Telephone(10/–)	15	10	13/9	..	7 5 6
Henley's (5/–) ..	20	20	21/3	..	4 14 1
4½% Pref. ..	4½	4½	21/3	..	4 4 3
Hopkinsons ..	15	15	46/3	..	6 9 13
India-Rubber Pref.	5½	5½	21/3	..	5 3 5
Intl. Combustion ..	32½	30	100/–	..	6 0 0
J. Lucas	15	15	58/9	..	5 2 0
Johnson & Phillips	15	15	50/–	+⅛	6 0 0
Lancashire Dynamo	20	20	52/6	..	7 12 5
Laurence, Scott(5/–)	15	15	10/6	..	7 2 11
London Elec. Wire	7½	7½	22/6	..	6 13 4
Mather & Platt ..	13½	10	42/–	+2/–	4 15 3
Metropolitan Elec. Cable. Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	83/9	..	4 15 8
Pye Deferred (5/–)	25	25	13/9	..	9 1 10
Revo (10/–) ..	5	20	23/9	..	8 8 5
Reyrolle	12½	12½	55/–	..	4 10 3
Siemens Ord. ..	7½	7½	23/9	..	6 6 4
Strand Elec. (5/–)..	4	2	2/–	..	5 0 0
S. Smith (1/–) ..	37½	50	6/3	..	8 0 0
Switchgear & Cowans (5/–) ..	10	15	8/9	..	8 11 6
Tel. Condenser(10/–)	Nil	5	10/–	..	5 0 0
T.C. & M.	10	10	40/–	..	5 0 0
Telephone Mfg.(5/–)	9	9	7/3	..	6 4 2
Tube Investments..	23½	23½	94/6	..	5 0 0
Vactric (5/–) ..	4	Nil	2/6	+6d.	—
Vickers (10/–) ..	10	10	16/3	+6d.	6 3 0
Ward & Goldstone (5/–)	20	20	16/6	..	5 19 9
Westinghouse Brake	17½	10	42/–	..	4 15 1
Walsall Conduits(4/–)	55	55	31/3	..	7 0 9
West, Allen (5/–) ..	7½	7½	3/9	..	10 0 0

* Dividends are paid free of Income Tax.

Stocks and Shares (*Concluded from page 72*)

three of the Indian companies in which the Oriental Telephone Co. is interested, at prices which are satisfactory enough from the shareholders' point of view. The board of the Oriental Telephone Co. advises acceptance of the offer. The Indian Government has the right to take over the undertakings in 1943, after one year's notice, but the present offer antedates the possible purchase and it is fairly safe to assume that proprietors of the Oriental Telephone shares will agree with the board that it is to their advantage to accept the offer now, rather than wait until 1943 when the future of the company will come under review.

The company showed progressive net profits from 1933 to 1938 inclusive, during which period dividends of 12 per cent., free of tax, were paid on the ordinary shares. For 1939 it paid 11½ per cent. net, and for the year recently ended the dividend was 16 per cent. less tax, equal, as the chairman stated the other day at the meeting, to 10.2 per cent. net. He remarked that the company should have no difficulty in maintaining the 16 per cent. dividend less tax. The company holds substantial interests in other telephone undertakings, for instance, the Hong Kong Telephone Co., the China and Japan Telephone and Electric Co., and the Rangoon Telephone Co., all of which are showing good results. The three Indian companies for which the Government has made an offer are the Bombay Telephone, the Bengal Telephone and the Madras Telephone Companies.

British Electric Traction

British Electric Traction deferred stock has further appreciated to 860, which is getting on towards the four-figure price paid by some of the recent purchasers who have been helping themselves to an additional amount in order to average. Stock has been changing hands in what look to be large amounts, considering the price. For example, £1,000 stock was bought the other day at about 860, representing, of course, £8,600 in cash. On the present dividend of 45 per cent. per annum, the yield at 860 is 5¼ per cent. It has to be repeated that, in these days, very few new issues are being made, and the possessor of money is hard put to it to find stock that pays over 5 per cent. on his money, with reasonable security.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Ashton-under-Lyne.—August 13th. Electricity Department. E.L.V. switch house and battery room (See this issue.)

Australia. — SYDNEY (N.S.W.). — November 13th. County Council. 33-kV switchgear and equipment for the Pyrmont power station.

Brighouse.—August 30th. Electricity Committee. 300-kVA transformer and switchgear. (See this issue.)

Epsom and Ewell.—August 18th. Electricity Department. H.v. and l.v. cable. (See this issue.)

Gravesend.—August 20th. Architect's Department. Water heating, water supplies, and electrical services at the police headquarters and fire station. (August 1st.)

New Zealand.—POSTS AND TELEGRAPH DEPT.—August 25th. Condensers and 3-conductor cords. August 29th. Cadmium-copper binders and tapes. September 1st. Tumbler switches and fuses. September 2nd. 60 tons of copper wire. September 5th. 60 miles of tinned copper wire.

AUCKLAND HARBOUR BOARD.—September 30th. Ten 5-ton electric cranes.

North Riding.—August 9th. County Council. Electric light plant at the children's sanatorium, Thornton Lodge, Thornton Rust, near Aysgarth. (August 1st.)

Plymouth.—August 13th. Electricity Supply Department. Valve for circulating water system, and rotary boiler feed pump. (July 18th.)

Warrington.—September 1st. Electricity Department. Cables, earthenware conduits, slabs, tiles and covers. (See this issue.)

Orders Placed

Durham.—County Assistance Committee. Accepted. Electric batteries, etc., for Bedburn Hall hospital (£85).—Cox Walkers. Electric motor fan and starter for Stockton institution (£35).—Keith Blackman.

County Council. Accepted. Twelve months' supply of electric lamps for the Shire Hall and Assize Courts and offices.—Luxram Electric Lamps.

Lichfield.—Electricity Committee. Recommended. Cable contract renewal for two years.—Standard Telephones & Cables.

London.—JOINT ELECTRICITY AUTHORITY. Accepted. Continuance of existing contracts for a further twelve months. Kiosks.—Crompton Parkinson. Special supplies.—General Cable Manufacturing Co.; Mollart Engineering Co. Ltd.

ST. MARYLEBONE.—Electricity Committee. Recommended. Meters for twelve months.—Chamberlain & Hookham; Ferranti.

LEWISHAM.—Emergency Committee. Accepted. Two double-oven cookers (£154) and toaster (£3 7s. 6d.).—G.E.C. Two double-oven cookers (£206), hot cupboard (£32), milk urn (£14), water urn (£6 10s.), and potato peeler (£38).—Simplex Electric Co.

Manchester.—Electricity Committee. Accepted. Annual supply of stores:—Dry batteries, etc., for flashlight lamps.—G.E.C. l.v. tail end boxes.—Sykes & Dyson. Empire tape.—Hamnett & Andrew. 420-V distribution switchgear.—English Electric Co. Cleaning of battery cells.—Tudor Accumulator Co. Modifications of circuit-breakers.—Ferguson, Pailin.

Public Health Committee. Accepted. Mobile X-ray unit.—Watson & Sons. Replacements to main set at Booth Hospital.—Metropolitan-Vickers Electrical Co.

Ossett.—Water Committee. Accepted. Installation of electric pumping plant at a waterworks (£2,850).—Layne Well System.

Salford.—Lighting Committee. Recommended. Fire extinguishing plant for West Street substation (£412).—Pyrene Co.

Wakefield. — Education Committee. Accepted. Electrical installation at technical college workshops (£128).—H. Goodyear.

Emergency Committee. Accepted. Lighting shelters (£7 19s. 6d. each).—W. Robb.

Watford.—Electricity Committee. Accepted. 1,300-kVA transformer (£249) and 1,250-kVA transformer (£220).—Metropolitan-Vickers.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashby-de-la-Zouch.—Canteen, Smisby Road; John Ferguson & Son, Ltd.

Atherton.—British Restaurant in Market Street, for U.D.C.; F. L. Boydell, surveyor, Town Hall.

Barnsley.—Day nursery, adjoining New Street clinic, for T.C.; H. Taylor, borough, surveyor, Town Hall.

Beeston.—School buildings (£2,000); county architect.

Boston.—Communal feeding centre at Kirton, for R.D.C.; W. R. Beardsall, surveyor, Council Offices, Market Square.

Bournemouth.—Laundry extensions, 66-8 Palmerston Road; Model Laundries, Ltd.

Brechin.—Proposed Houses (25), for T.C.; burgh surveyor, 30, Panmure Street.

Brierley Common.—Additions to Isolation Hospital for 50 more beds; the secretary, Hemsworth & Wombwell Joint Hospital Committee, Hemsworth, near Pontefract.

Cheltenham.—Canteen, Tennyson Road; Smiths Systems, Ltd.

Conversion 39 Rodney Road to offices and flats; Weldon Properties, Ltd.

Chesterfield.—British Restaurants at Killamarsh and Eckington (£2,588) for R.D.C.; J. B. Wikeley, surveyor, Rural Council House.

Cork.—Additions and alterations to St. John's and St. Francis' Hospital, for South Cork County Board of P.A.; R. Flavin, acting secretary, Boardroom, Douglas Road.

Coventry.—Hall-gymnasium at Canley Youth Centre, Queen Margaret's Road, for E.C.; F. H. Harrod, Director of Education, The Council House.

Reconstructing Butts Pavilion as British restaurant (£6,760), for T.C.; D. E. E. Gibson, city architect, 1a, Warwick Row.

Darlington.—Additions, York Street; T. Summerson & Sons.

Droitwich.—Structural alterations to "The Chequers" Hotel, Cutnall Green; T. H. Hill (proprietor).

Dukinfield.—Restoration of houses, Ogden Street, for Mr. Critchlow; H. Lindley, architect (Lindley & Gibson), Market Avenue, Ashton-under-Lyne.

Ealing.—Additions and alterations, 62, The Broadway; N. Green & Co., Ltd., builders, New Broadway Buildings, W.5. Alterations, 83-85, Uxbridge Road; W. J. Dickens, Ltd., builders, 19, The Broadway, W.5.

Eccles.—Office extensions, Ellesmere Foundry, Patricroft; Sir W. H. Bailey & Co., Ltd.

Guildford.—Alterations, 42 to 72 Ludlow Road; 2 to 17 Bedford Road; Friary, Holroyd & Healey's Breweries, Ltd.

Four restaurants (£5,600); borough engineer.

Hampshire.—Six school kitchens; county architect, Winchester.

Hendon.—Extensions to premises; Boosey & Hawkes, Ltd.

Hull.—Further British Restaurant, for T.C.; city engineer, Guildhall.

Jarrow (Co. Durham).—Community kitchen in Finchale Terrace; kitchens at the Baptist school and Valley View schools; three existing kitchens to be converted into restaurants; J. S. Weir, borough engineer, Town Hall.

Conversion of Danesfield, Bede Burn Road, into maternity hospital for the T.C.; direct labour.

Keighley.—Parish hall, Kildwick, for Parochial Church Council; Rev. A. T. Walker, The Vicarage, Kildwick.

Loftus (Yorks).—British Restaurants; U.D.C. surveyor.

London.—ST. MARYLEBONE.—Factory extension 14-6, Burne Street; H. Kenchington.

Mansfield.—Extensions, Institution (£2,380); C. H. Hill & Sons, Ltd.

Newcastle-on-Tyne.—Additions to factory, for Angus & Co., Ltd.; Hetherington & Wilson, architects, County Chambers, Westgate Road.

Newcastle (Staffs).—British Restaurants for T.C. (£1,530); H. Stubbs, builder, Cross Heath, Newcastle-under-Lyme.

North Riding.—Kitchen, Malton Grammar School; dining room, Saltburn High School; equipment for meals at 11 other schools; J. W. White, county architect, County Hall, Northallerton.

Northumberland.—Three more land workers' hostels in the county; P. L. Browne, Son & Harding, Pearl Buildings, Newcastle-on-Tyne.

Oldham.—Adaptation of billiards hall, Hollinwood, for municipal restaurant, for T.C.; borough engineer, 75, Union Street.

Runcorn.—Adaptation of Heath House, High Street for fire station, for U.D.C.; A. B. Cunningham, surveyor, Town Hall.

Shropshire.—School canteens (£10,000); county architect.

Smethwick.—Bakery reconstruction, 18, Waterloo Road; S. R. Shepherd.

Steel building, Bridge Street works; Smethwick Drop Forgings, Ltd.

Spalding.—School canteens at Butterwick, Kirton and Sutton Bridge districts for Lincs. Holland Div. E.C.; J. R. McKnight, Director of Education, Education Offices.

Sunderland.—Canteen; T. W. Greenwell & Co., South Dock.

Tideswell.—Improvements to Parish Church, for Parochial Church Council; Rev. R. F. Edwards, The Vicarage, Tideswell, near Buxton.

Upton Colliery (Yorks).—Canteen for the colliery company.

Uttoxeter.—Houses, Steinhouse Lane, Admaston, for R.D.C; C. E. Ingham, surveyor, Council Offices, Market Place.

Wakefield.—Ten schools in concrete blocks on various sites, for West Riding E.C.; H. Wormald, county education architect, County Hall.

Washington (Co. Durham).—British Restaurant at Washington Station. J. Harrison, surveyor, Urban Council Offices.

Waterford.—National schools, Mount Sion, for Christian Brothers; F. D. Shortall, surveyor, 10, Leinster Street, Dublin, C.17.

West Lothian.—Police headquarters at Linlithgow; Dick Peddie, Todd & Jamieson, architects, 8, Albyn Place, Edinburgh.

Wetherby.—Pump house and pumps, for R.D.C.; H. Smith, clerk, Council Offices.

Whitby.—Alterations to White House Hotel; conversion of premises into British Restaurant, and repairs to houses; U.D.C. surveyor.

Whitstable.—Building for British Restaurant, site of gardens at Oxford Street Boys' School, for U.D.C.; surveyor, the Castle.

Wigan.—Permanent camp near Wigan, for Wigan and District Local Boy Scouts Association; B. D. Hallett, chairman, Old Elms, Elmfield Road.

Wolverhampton.—Works alterations, Sedgley Street; Dallas & Lloyd.

Woolwich.—Additions to premises; T. A. Boughton, 184, Sangley Road, Catford.

Premises reconstruction, for B.C.; borough engineer.

York.—Additions, Mount School, Dalton Terrace; Society of Friends.